NOV 28 1898

THE IRON TRADE REVIEW

VOL. XXXI. CLEVELAND, O. NOVEMBER 17, 1898. CHICAGO, ILL NUMBER 46

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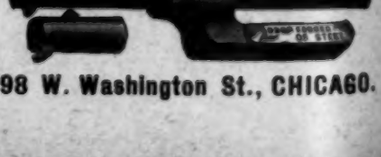

98 W. Washington St., CHICAGO.

THE IRON TRADE REVIEW

VOLUME XXXI. CLEVELAND, O. NOVEMBER 17, 1898. CHICAGO, ILL. NUMBER 46

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

But for the fact that the late summer purchases in pig iron and steel were of unusual proportions, the iron trade would now see the beginnings of a buying movement covering requirements well into the new year. So far as the immediate situation can give light, such general contracting is likely to wait for the beginning of the new year; and it may be expected that the indications of the next six weeks will be closely watched by the entire trade. Whether Bessemer pig iron and steel billets are yet in natural equilibrium is a question of interest to steel makers and their customers. The pressure upon converting mills noticed two months ago, is relieved in a measure, and as for Bessemer iron, production is still more than ample. The reductions in stocks of pig iron have been on the foundry side of the market and if the Bessemer situation is to be improved it would seem that it will be through the swinging of some Bessemer capacity over to non-Bessemer irons. Here comes in the question of ore supply; and it appears that more furnacemen have attempted of late to prepare themselves for longer foundry runs in the next six months, than could be taken care of, in the scarcity of desirable non-Bessemers from Lake Superior. So far as statistics indicate, there is a better outlook in the foundry trade for a furnace fixed to make either iron. At the sharply competitive prices on non-Bessemer ores the past season—cheapness entirely out of joint with all other conditions—the foundry furnaces have had an advantage over Bessemer stacks, with all allowance for the higher fuel cost of the former. There are indications that the producers of non-Bessemer ores will make a more successful attempt that heretofore to establish agreed prices for 1899. The fear of cheap Southern iron will not deter them this time. The Southern furnaces continue to hold their prices relatively above those asked for Northern grades; and the statement that the leading Southern producer has sold 100,000 tons for export since Aug. 1, together with the stock statistics at home and the steady taking up of all the iron that can be shipped to the foundries, accounts for the position taken. Stock figures show a reduction of 48,500 tons in October, with production increasing through the month. Between June 1 and Nov. 1 stocks at furnaces were reduced 222,000 tons and storage warrant stocks, in addition, fell 113,000 tons between March 1 and Nov. 10. In the first 10 days of November, 27,000 tons was shipped out of warrant yards. There is a stiffening of prices on Northern foundry iron here and there, but most furnaces have made no change. Sales are being made steadily, but in small lots as a rule. Some Bessemer iron has been sold at from $9.50 to $9.65 valley furnace and $10 and $10.15, Pittsburg. An exchange of pig iron for steel, by a large Pittsburg producer, due to the temporary shutting down of a steel plant for repairs, has given rise to some unfounded rumors of heavy selling. Billets can be had at $15, maker's mill, and are weak. Some Eastern business in billets is under negotiation on the basis of $17, Philadelphia. The export demand for steel is growing and the increasing tonnage of billets, sheet bars, rails, pipe, and other products now under inquiry indicates how strong is the situation on the other side. Prices are not a sacrifice, as at the beginning of this trade, but a fair profit is being made. In the case of the big Coolgardie contract for riveted pipe, it is becoming something of a question whether American plate mills which went after it so keenly, can handle it, and do justice to home contracts. The rail manufacturers expect to perfect this week their plan for a selling company which shall take all the product of the mills. The export trade, now at the rate of 300,000 tons a year would be pushed vigorously. The latest suggestion of price is $20 at all mills.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World*, 705 PUBLICATION BUILDING, Nov. 16.

Export inquiry continues to be the strongest feature of the market. If there is any excitement at all it is in the matter of the tin plate combination which is now being railroaded through as fast as possible. Definite information as to the status of the matter is difficult to obtain, but the general opinion is that the combine is a "go." Yet some predict a failure at the last moment. The near future will solve all questions now in doubt.

PIG IRON.—The rumors current in the past week indicating sales of round lots of Bessemer iron by a large local producer is without confirmation. One deal between a Pittsburg interest and a Western Pennsylvania steel company, in which Bessemer iron was traded for steel, is the probable occasion of the report. Some small lots in outside hands have been on the market at something below furnace prices. Sales on behalf of furnaces the past week were about 20,000 tons at from $10 to $10.15, Pittsburg. Very little iron is coming from the valley, where the nominal market is $9.65 to $9.75. Foundry irons and gray forge are quiet. Business in the latter is being sought for next year, but the buyers want considerable concessions from ruling prices and little is being done. Foundry irons are quoted on the basis of No. 2 at $10 to $10.15; gray forge from $9.20 to $9.30, Pittsburg, and $8.75 to $8.85, valley. We quote as follows:

Bessemer, valley furnace	$ 9.63 to $ 9.75
Bessemer, Pittsburg	10.00 to 10.15
No. 1 Foundry	10.50 to 10.60
No. 2 Foundry	10.00 to 10.25
No. 3 Foundry	9.65 to 9.85
Gray Forge, valley furnace	8.75 to 8.85
Gray Forge, Pittsburg	9.20 to 9.30

BILLETS AND RODS.—Billets are still nominally quoted at $15.25 at the mill, but sales have been made below this price. The export demand is flattering and foreign orders net more than domestic trade. Sheet bars are very quiet, the quotation being from $16.25 to $16.50. Rods have eased off, some hitherto idle mills having started up. The quotation is from $20.75 to $21.25. The buyers of tin plate are falling over each other in their endeavors to place orders at present prices for delivery running into next year. The seller, however, is taking only such orders as he desires, and few if any for next year's delivery, as the future is too uncertain.

PLATES.—There is nothing more definite to announce about the Coolgardie plate order. The arrangement by which this large tonnage will come to the United States is making progress, and Pittsburg steel is expected to enter largely into the contract. General business is of good volume and mills able to make deliveries as required on considerable lots are able to get a good price on new business. The railroads are steady buyers. We quote: Tank, 1.10c to 1.15c; shell steel, 1.20c; flange, 1 25c; fire box, 2c and upwards.

STRUCTURAL MATERIAL.—Outside of the fact of an increasing export business in beams the market is devoid of incident. There is a steady run of business and prices are stationary, as follows: Beams and channels, 3 to 15 inches, 1.20c; 18 to 24 inches, 1.30c; tees, 1.25c; zees, 1.20c and angles, 1.10c. Universal plates are generally quoted at 1.10c but some firms are holding for 1.15c and are getting business.

SHEETS.—The demand for black sheets seems to have fallen off during the last week. No. 28 is still quoted from 1.90c to 1.95c, but these prices are shaded in case of desirable orders. Galvanized sheets are in pretty fair demand, at least better than black. They are nominally 80 and 10 per cent off list, but concessions are being made on this quotation.

PIPES AND TUBES.—The mills seem unable to gain appreciably on their order books. The volume of business continues excellent and continued operation through the winter months is now almost assured. The additional discounts of six tens for less and six tens and five per cent off list for carload lots are still being quoted, with concessions on large orders. Base discounts are: Butt weld, black, 55 per cent off; lap weld, black, 65 per cent off; butt weld, galvanized, 47½ per cent off; lap weld, galvanized 52½ per cent off. Discounts on merchant boiler tubes are as follows: 2¼-inch and smaller, 72½ per cent off; 2½ inch and larger, 75 per cent off. Inserted joint casing is now quoted at 60 off and screw and socket joint casing at 60 and 10 per cent off.

SPELTER.—The report that the appreciation of spelter was caused by the fact of certain ore deposits being worked out, is denied in toto. There is enough in sight, authorities say, to supply the market for the next three or four years. Spelter is quoted at $5.20 this week and shows no signs of weakness.

FERRO-MANGANESE AND SPIEGEL.—The former is quoted at $50 for 80 per cent domestic delivered, and the latter at $23.50 to $24.

IRON AND STEEL SKELP.—The market is steady in prices with good demand for all kinds. Prices are as follows: Grooved iron skelp, 1.10c to 1.12½c; sheared iron skelp, 1.20c to 1.25c; grooved steel skelp, 1c to 1.05c; sheared steel skelp, 1.10c to 1.12½c.

RAILS AND TRACK MATERIALS.—The situation in rails is unchanged pending final action at New York. No quotations are given out, though it is understood some railroads are ready to place their orders. Track materials are in good demand with the following prices being quoted: Spikes, 1.45c; track bolts, 1.65c to 1.70c; splice bars 1.10c to 1.15c; links and pins are quoted from 1.20c to 1.27½c.

OLD MATERIAL.—The buying continues to be of a "hand-to-mouth" character, with no marked change in prices. Iron rails have sold as heretofore at $13.75. Other quotations are as follows: Wrought iron scrap, $11.50, net valley; cast borings, $6; busheling scrap, $9, net; car wheels, $10.25, gross; cast scrap, $9 gross; iron axles, $6, net; steel axles, $12.50, gross; charcoal scrap, $10, gross; wrought turnings, $6.75, net, valley.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World.*
1522 MONADNOCK BLOCK, Nov. 16.

The situation may be summed up as being strong and quiet. The demand for all classes of material is fair, and for some is large, but the sales, for various reasons, have not been heavy in the week. Many mills are so full of business that they are unable to accept further orders except for delivery beyond the first two or three months of next year, and as a large proportion of the business in the market at present is of the immediate delivery variety, buyers are having some difficulty in placing their orders. The market is very firm in all branches. There is no disposition observable on the part of mills or furnaces to take business at less than the current quotations, and on certain grades of steel some mills are asking prices above the market level.

PIG IRON.—Sales last week were not especially large, and the demand does not indicate an increase in the immediate future. One or two inquiries for round lots of iron have come in, but so far none of them have been placed. The bulk of the business going at present is in lots of car loads up to 100 or 200 tons. Buyers are taking their iron as rapidly as they can get it from the furnaces, and nearly all the foundries in this territory are running full time and using considerable quantities of iron. Quotations remain unchanged, as follows:

Lake Sup. Charcoal	$11 50@$13 00	Southern Coke No. 3	$10 35@10 60
Local Coke Fdy. No. 1	11 50@12 00	Southern No. 1 Soft	10 85@11 10
Local Coke Fdy. No. 2	11 00@11 50	Southern No. 2 Soft	10 60@10 85
Local Coke Fdy. No. 3	10 75@11 00	Southern Silveries	11 25@11 50
Local Scotch Fdy. No. 1	11 50@12 00	Jackson Co. Silveries	12 50@14 50
Local Scotch Fdy. No. 2	11 00@11 50	Ohio Strong Softeners	12 00@12 50
Local Scotch Fdy. No. 3	10 75@11 00	Alabama Car Wheel	15 00@16 00
Southern Coke No. 1	10 85@11 10	Malleable Bessemer	11 50@12 00
Southern Coke No. 2	10 60@10 85	Coke Bessemer	11 50@12 00

BARS.—There has been a good demand and fair sales of small lots, and two or three good sized orders were closed last week. The demand seems to keep up well, and mills look for the immediate future to be fully as good, in point of orders, as the past few weeks have been. The market is unchanged, and no concessions are being made on the general run of business. Quotations are made at 1.05c to 1.10c for common iron, 1 10c to 1.20c for guaranteed iron and 1.15c to 1.20c for soft steel bars from strictly billet stock.

RAILS AND TRACK SUPPLIES.—It has been reported here that the rail makers have made considerable progress in their agreement, and that something definite may be expected to be announced within the week. It is said the arrangement as planned includes a central selling agency for all mills in the pool, and a uniform selling price of $20 a ton at all mills, regardless of location. Reports have it that all but one or two mills, and those smaller and less important ones, are included in the agreement. The railroads appear to be getting very impatient because mills will not sell rails, and it is feared the delay may cause some roads to purchase a smaller tonnage than they have figured on heretofore. Mills are even refusing to ship rails to roads, with the proviso that price be settled after the pool agreement is finished. Business in light rails last week was good, and included several good sized orders. These are quoted at $20 to $21 and upwards. Other quotations are as follows: Steel splice bars, 1.15c to 1.25c; track bolts with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.55c to 1.60c.

BILLETS AND RODS.—No sales of either billets or rods were made in this market last week. The local mills are entirely out of the market for the present. Prices are nominal at $17 for billets and $22.50 for rods.

CAR ORDERS.—Two or three good orders for cars were placed last week in this market. It is reported the Pennsylvania system is figuring on several thousand cars and that the order will be placed immediately. Car material of all kinds has been in good demand.

STRUCTURAL MATERIAL.—General business in small lots was excellent last week and gives every promise of continuing so. No large contracts were placed, but it is expected that several large projects which have been under consideration for some time past will come up within a short time. Quotations are unchanged, as follows: Beams, 15 inch and under, 1.35c to 1.40c; 18-inch and over, 1.45c to 1.50c; angles, 1.25c to 1.30c; plates, 1.20c to 1.30c; tees, 1.40c to 1.45c; zees, 1.35c to 1.40c. Small lots from stock are quoted at ¼c to ½c higher.

PLATES.—There is a very heavy demand for plates—much larger, in fact, than the mills can supply. In view of this fact, it is remarkable that prices have not advanced higher than they are at present. One of the large Pittsburg mills is making a price of 1.30c, Chicago, on plates, and refusing to consider offers at less than this. Other mills are higher than the prices we make, but sellers are easily found at our quotations. Sales of considerable size were made last week, including one order of 1,500 tons of ship plates, to go to West Superior for a new Bessemer Steamship Co. barge. Quotations are made as follows: Tank plates, 1.20c to 1.30c; flange steel, 1.30c to 1.40c; firebox steel, 1.85c to 5c.

SHEETS.—Considerable demand is noticed for some weights of black sheets, while others are quieter. Galvanized sheets are selling well, the week's business including several good sized orders. Quotations are made at 2c to 2.10c for black sheets, and 80 and 5 per cent discount for galvanized.

MERCHANT STEEL.—The demand is good and sales last week were fully as large as those of the week previous. Some mills are so well sold ahead as not to be able to accept all the business offered them. Quotations follow: Open-hearth spring, tire and machinery steel, 1.65c to 1.75c; smooth finished machinery steel, 1.60c to 1.70c; smooth finished tire, 1.50c to 1.60c; tool-steel, 5.50c to 7.50c; specials, 11c and upwards.

SCRAP.—There have been very few salse of any size or of any grade of scrap. The demand appears to be small and easily satisfied. The market is held quite firm by dealers, who seem to want higher prices. Dealers' selling prices are as follows:

Old iron rails, gross,	$12 50@$12 75	Axles, net	$14 25@$14 75
Old steel rails, long, gr.	10 50@11 00	Cast borings, net	4 25@4 50
Old steel rails, short	8 75@9 00	Wrought turnings, net	6 00@6 50
Old wheels, gross	11 00@11 50	Axle turnings, net	7 00@7 25
Railroad forge, net	11 50@12 00	Mixed steel, gross	7 45@7 50
Dealer's forge, net	10 00@10 50	Stove plates, net	5 75@6 00
No. 1 mill, net	7 50@8 00	Heavy melting stee, gr.	8 25@8 50
Heavy cast, net	8 50@9 00	Old iron splice b., net.	12 75@13 00
Malleable cast, net	8 00@8 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., Nov. 16.

The season of ore shipments is drawing to an end with conditions favorable to a considerably heavier call upon dock stocks in the coming winter than in either of the past two years. If the showing for the season should prove to be, in round numbers, only 1,000,000 to 1,200,000 tons in advance of last year, it is counted entirely probable, from the preparations already making for winter shipments from the docks, that the statement of May, 1899, will be well past 1,000,000 tons less than that of last May. The dock and railroad facilities at Lake Erie ports have been simply inadequate to the handling, within the navigation season, of the increase of business involved in taking direct from vessel to furnace such an ore volume as that of 1898. On the other hand, the larger outputs of the furnaces in the Pittsburg and valley districts require greater ore-stocking facilities than most of them have provided. All the docks are anticipating a greater winter activity, therefore, than usual.

PIG IRON.—The situation, so far as stocks at valley furnaces are concerned, changes but little, the aggregate for the two valleys on Nov. 1 being almost identical with that for Oct. 1. Bessemer iron is reported sold at $9.50 to $9.65 valley furnace, a transaction of 5,000 tons being noted at the former figure. Some variation appears in statements as to the amount of iron for sale outside the association. Some iron taken on coke trades has been on the market, and it has been sold at a figure somewhat under furnace quotations. It does not appear that a large Pittsburg producer has gone into the market to sell Bessemer iron, as has been rumored, but that an exchange of Bessemer for billets has been made—in effect, a conversion deal, that fills in the interval of a steel works shut-down. Some Bessemer iron has been taken at Pittsburg in the week at $10.10 and $10.15. The market for foundry iron is generally unchanged, with the range $9.50 to $9.75 for No. 2, though a particularly well sold furnace is asking $10. The trade is mostly in 50 and 100-ton lots, with shipments well taken. We quote gray forge at $8.75 to $8.85 valley and $9.25 Pittsburg, with the market steady for both forge and basic. Lake Superior charcoal continues firm, with no promise of any large stocks at lower lake ports for winter customers. The higher numbers are still scarce. We quote f. o. b. Cleveland:

Bessemer	10 40@10 55	Valley Scotch No. 1	$10 40@10 50
No. 1 Strong Foundry	10 40@10 65	Valley Scotch No. 2	10 15@10 40
No. 2 Strong Foundry	10 15@10 25	Gray Forge	9 40
No. 3 Foundry	9 65@ 9 90	Lake Superior Charcoal	11 50

FINISHED MATERIAL.—The weakness in billets and rods—the former quoted $15, Cleveland and the latter $21—has had some effect on the wire and nail market, which are weakened, also, by the failure of producers to maintain an agreement on price. The largest Central Western producer has been naming lower prices in view of recently increased production, and the meeting appointed for Nov. 10 was not held owing to the refusal of two interests to hold prices. We quote wire nails at $1.30, Cleveland; smooth wire at $1.15; barbed wire at $1.40 and $1.70. The differential of 2½ cents between Pittsburg and Cleveland on nails and smooth wire is not observed and the gentlemen's agreement is practically inoperative. The shipyard business mentioned last week amounts thus far to two boats for the Bessemer Steamship Co.—the steamer going to the Globe Iron Works, Cleveland, and the barge to the American Steel Barge Co., West Superior. Plates on one go to Chicago and on the other to Pittsburg. Shapes went to Pittsburg and to the East. Further shipbuilding is talked of, but nothing tangible has developed.

Where early deliveries of considerable lots must be made, plates are higher than for deliveries for next year. On lighter plates 1.17½c Cleveland could be done, but 1.20c is also named. Sheet and bar mills are making some concessions to get winter business. Valley mills have quoted 95c flat recently on iron. From Pittsburg mills steel bars are quoted 95c and this is shaded. On No. 27 black sheets mill shipments are made at 1.90c Cleveland, and a shade less. Some scattering lots of beams and channels and universal plates have been closed in the week but the tonnage was not large.

CINCINNATI.

Nov. 15.

From the standpoint of the Southern iron master the market should soon advance. Their yards are stripped bare of iron; they are behind on shipments, and there is a steady demand from abroad that is greater than they can supply. While there has been no domestic buying of any consequence, yet in the aggregate the recent tonnage sold for home consumption is not small. This iron has been sold at the advance prices, showing that in some markets at least in spite of the competition of the Northern furnaces, that these figures are obtainable. The Tennessee Coal, Iron & R. R. Co. has sold in round figures 100,000 tons of iron for export since Aug. 1. Another furnace company in the Birmingham district reports that its mails daily bring applications from Europe from dealers or consumers for iron. It is this export trade which, now in its current volume and in its future possibilities, makes the Birmingham furnaces so pronounced in their ideas of prices. They say that no matter what their Northern competitors may do, that Southern iron must be taken into account in arranging prices. Yet in spite of the strong conditions named, there is a conservative attitude on the part of Northern sellers, and the approach of the season of inclement weather and of the ordinarily quiet time of the year is having its influence in modifying the effect of the very firm attitude of Southern furnaces. There is a continued demand for iron in small lots, and we quote as follows, f. o. b. Cincinnati: Southern coke No. 1 foundry, $10 to $10.25; No. 2, $9.75 to $10; No. 3, $9.25 to $9.50; No. 4 and gray forge, $8.75 to $9; mottled, $8.75 to $9; No. 1 soft, $10 to $10.25; No. 2, soft, $9.75 to $10; Hanging Rock charcoal, No. 1, $14.50 to $15.50; Jackson Co., silvery, No. 1, $12 to $12.50; standard Georgia car wheel, $14.25 to $15.

PHILADELPHIA.

Nov. 15.

The large total of foreign inquiries continues to be the feature of the situation. This combined with decreasing pig iron stocks gives a strong undertone to the market in the interval of only moderate new business. While the trade generally discusses the possibility of a break in prices as the quiet time of the year approaches, it is generally with the verdict that little change is to be looked for, in view of the well sustained consumption. The foreign business under negotiation is estimated in some quarters to be fully 200,000 tons. This includes 100,000 tons of wrought and riveted pipe for Australia and fully 50,000 tons of rails for European delivery. It is a question whether the Australian contract can be handled in this country even though the plate manufacturers co-operate in the way that has been discussed and distribute the tonnage among them. In the Pittsburg district, plate mill capacity is reported so well taken up, with the heavy vessel contracts let early in the fall by Atlantic yards, in addition to business that has been steadily flowing to the mills meanwhile, that there is not the same desire to capture a large share of the big Coolgardie order that was shown when it was figured on. The negotiations now under way for the shipment of material to all quarters of the earth indicates a rapidly increasing demand for American steel. The handicap of high ocean freights is expected to grow less in the next month or so; but in some cases freights will not stand in the way, as the material must be had. It is conceded that the strong showing of home consumption of iron would lead to an advance in prices, but for the belief that the next two months will show a decline in consumption. Something will depend on rail business. If the rail mills should be busy early in the coming year that would be an important aid to a strong market. The business in the past week, in pig iron, has been of only moderate proportions. We quote on No. 1X foundry, $11.75 to $12.25; No. 2X foundry, $11 to $11.50; No. 2 plain, $10.50 to $10.75; standard mill iron, $10 to $10.25; ordinary mill iron, $9.75; basic, $10 to $10.25; Bessemer, $12; low phosphorus, $16 to $16.50. Some business in billets is in sight and $17 is about the market. Finished material is going out of the mills in large volume, but new business is not so plentiful and slight concessions would be made on desirable orders. Old material is firm because of small supplies in some lines, but consumers are letting stocks run down for the end of the year and are not buying much.

THE IRON TRADE REVIEW
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INDUSTRIAL WORLD.

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SIGNS OF PROMISE.

The most optimistic views of the financial and commercial situation are coming week by week from the centers of strength in the world of finance All considerations, financial and industrial, converge to the conclusion that 1898 will go down a year of unprecedented records in important particulars. To have been at war, with the burdens of taxation and the distractions and disturbances that belong to war, and yet to have outdone every preceding achievement in trade and finance, is a fact whose mighty significance is scarcely comprehended. One or two items in the financial record now being wrought out in New York will serve to point the general statement:

Clearing house vaults contain the extraordinary sum of nearly $170,000,000 of gold which is there to stay because it has come to pay debts.

The conditions that have prevailed in this country in the past two years have increased the wealth of the United States by hundreds of millions, according to the estimates of conservative capitalists. This may be counted a permanent addition to the capital of the country.

The opinion has been expressed in money circles that the securities now dealt in upon stock exchanges do not furnish sufficient opportunity for investment for the capital which will flow out, now that the security of our finances seems guaranteed for a term of years. The unfortunate feature of this condition is the stimulus it gives to the operations of trust promoters and their stock issues of three for one, even so stable an industry as iron and steel manufacture being not exempt from such manipulations.

Gauged by the developments in industry, the outlook is not less promising. The commercial awakening that has come in the past few years from the simultaneous effort of all manufacturing countries to extend their trade in new fields, is being emphasized in a most impressive way. Unmistakably the world's wants are growing. Contact with higher civilizations has begotten new desires among people heretofore untouched in their isolation. There is an evident shortage in the carrying capacity of the merchant countries, as evidenced in the large additions now making to the shipping of the world. Incidental to the commercial and industrial revival in distant countries is the activity in railroad building which has called for such large shipments from the rail mills of the United States in the past 10 months.

How these conditions have affected the iron industry is seen in the strong tone of weekly reports from the markets of Great Britain, Germany and Belgium. The output of British shipyards in October exceeded all records, so far as the Clyde and the Wear are concerned. Shipbuilding material has advanced in consequence and the overflow to the United States is more and more of a factor. What is true of the insufficiency of the world's carrying capacity is certainly true in greater measure of the transportation facilities of the United States. The handicap of car shortages is felt from one end of the country to the other; and the two years of unexampled railroad traffic through which we have just passed, make large expenditures for railroad equipment in the coming year inevitable. In a recent article on the railroads of the country, Duane Doty, of the Pullman Palace Car Co., says that, exclusive of sleeping cars, the railroads of the United States have 1,325,000 cars of all kinds. Considering the life of a freight car 12 years, its earnings after that time barely keeping it in repair, the theoretical scrap-pile contribution is about 100,000 freight cars a year. This means that 100,000 cars a year are needed for replacements alone. That was about the average, indeed, in 1890, 1891 and 1892. But in 1893 the total fell to 52,000; it was 18,000 in 1894; 38,000 in 1895; 52,000 in 1896; and 45,000 in 1897. The present year will show an advance toward the normal construction record; next year should show a great stride farther forward, and an increase over 1898 in rail requirements. With foreign business, a year's programme of close to 2,000,00 tons in T and girder rails is not an unreasonable expectation. Construction enterprises, which are next in importance to railroad work in their contribution to the iron and steel trade, will be a larger factor in the coming year if the plethora of money has its usual effect. The war scare and then the war cut off much of such work for this year; but conditions could scarcely be more propitious for these ventures than at the present time. We have made no reference in the above to the large tonnage of vessel work under way at the Seaboard nor to the large promise the coming year holds out both from Government and commercial sources. The unanimity which leading legislators and manufacturers have shown in their expressions on this subject leave no doubt as to some early practical outcome of the agitation for an American-built, American-owned and American-manned merchant marine.

It is a significant fact that this optimistic outlook for the iron industry in foreign countries and at home, is over and above a record that in itself is unparalleled. A close estimate of the pig iron production in the United States in 1898 would put it be-

tween 11,500,000 and 11,600,000 tons. Since March 1, when stocks of iron at furnaces were 825,000 tons, these have been drawn upon to the extent of 245,000 tons. In the same interval, pig iron storage warrant stocks have been reduced 113,000 tons. Such a consumption is far beyond any record. Quite 10 per cent of it is on foreign account, for iron and steel shipments abroad in crude and finished forms, including all machinery, are at the rate of not less than 100,000 tons a month. The statement is made, moreover, that since Aug. 1, one Southern producer has booked an average of 1,000 tons a day from foreign customers.

No reference has been made above to the well known conditions of prosperity in agriculture, which has been literally the basis of the country's good fortune in the past two years, the purpose being merely to emphasize again the elements of a strong situation in the monetary and commercial worlds, that is full of promise for the iron trade. It goes without saying that whatever of profit grows out of these conditions will be divided by producers who thrive on large tonnage at low prices.

PERSONAL.

Joseph E. Thropp, owner of Everett Furnace, at Everett, Bedford County, Pa., was elected to Congress last week from the 20th Pennsylvania District.

L. D. Henshaw, lately of Sparrow's Point, has accepted the position of chief engineer of the Mt. Vernon Bridge Co., Mt. Vernon, O.

James Jenks, a Detroit machinery dealer, widely known among machinery and tool builders of the country, died Nov. 10, aged 62 years. He had been in business for nearly 45 years.

Chas. L. Sawyer, mechanical engineer, died at sea Oct. 27, on his return from a trip to Europe in the interest of the Cleveland Machine Screw Co.

A. Kurrwernhart and Karl Prubel, connected with the steel works at Teplitz, Austria, have been in Cleveland the past week. They are making a tour of the steel-making districts of the country.

Jeremiah Head, of London, representing the Enlish owners of the Otis Steel Co., returns to England this week after a short stay in Canada and in Cleveland, devoted to professional work. Mr. Head and his son, Mr. A. P. Head, are gathering material for a paper to be presented in February before the Institute of Civil Engineers, in London, on the Lake Superior iron ore region and its contribution to the low costs achieved by American steel makers.

Michael Baackes, one of the founders of the Baackes Wire Nail Co., Cleveland, and for 12 years identified with the "Baackes" mill, which became part of the Consolidated Steel & Wire Co.'s properties and later was taken by the American Steel & Wire Co., has resigned as manager of the mill and is succeeded by M. B. Garvey, who has been superintendent of the Beaver Falls mill of the American Steel & Wire Co. Mr. Baackes has shown exceptional ability as an organizer and manager and has been a prominent figure in the wire nail industry. His plans include a trip to Europe in the coming year. Meantime he is interested in the formation of a company for the manufacture of needles, employing an automatic machine patented by Eugene Frontaine.

JUDGE HALLETT, of the United States Circuit Court, has issued a temporary injunction in Denver, restraining the Southern Pacific and other Western railroads from putting into effect, in violation of the ruling of the Interstate Commerce Commission, a freight tariff which would exclude the product of the steel mill of the Colorado Fuel & Iron Co., of Pueblo, Col., from Pacific Coast points. The new rates from Pueblo were the same as those from Chicago. The demurrer of the Southern Pacific Co. to the suit of the Fuel & Iron Co. in which a claim for damages is made, was overruled and 30 days given the company to file an answer. The railroad company is required to file a bond of $20,000.

PROGRESS OF THE TIN PLATE TRUST.

The tin plate manufacturers of the country have been generally represented at the meeting in Pittsburg the past week in which details of the proposed consolidation were discussed and subscriptions taken for the stock of the new "American Tin Plate Co."—if it shall be decided to take the name of one of the constituent companies. This is the first occasion on which the plans of the Moore syndicate that has been promoting the enterprise have been discussed before a meeting of the manufacturers. Negotiations previously have been with individual companies. The conference of last Thursday and Friday was not to settle terms for the purchase of plants, but to receive subscriptions to the stock of the new company. D. G. Reid, of Chicago, treasurer of the American Tin Plate Co., of Elwood, Ind., is quoted as follows on the object of the Pittsburg meeting:

"The manufacturers are here to subscribe for stock in the new company. The price has been agreed on for each plant, making a total of $15,000,000 for the 40 plants that will be consolidated. It will require several days to accomplish this. The companies have agreed to accept the prices offered them, and they are subscribing liberally for stock. I believe the preferred stock of the new company will be placed at $20,000,000, and Eastern capitalists are prepared to subscribe for $5,000,000 necessary to capitalize the company. The charter for incorporation will be taken out in New Jersey. I have heard no persons mentioned as the probable officers. I believe the central office will be located in Pittsburg, as the majority of the mills are located in the Pittsburg and Wheeling district."

Pittsburg advices are that the last of the $15,000,000 of stock to be taken by manufacturers was subscribed early in the present week, and that the $5,000,000 to be taken by outside capital will be distributed among banking interests in Chicago, Philadelphia and New York. It would appear that the original statement that the tin plate manufacturers were to receive cash or stock, at their election, was in error. The cash offer, it is believed, was made in very few instances, and the attraction to most manufacturers is the liberal valuations put on their plants, and the prospect of economies in production and distribution offered by the consolidation, and of some increase of price—all together warranting an expectation of dividends that will not come, under the disastrous competition of the over-crowded industry of to-day.

The promoters of the consolidation have been widely advertising for several months now, the anticipated success of their efforts, and almost weekly publications in the stock columns of the daily newspapers have dwelt on the attractiveness of the new stock as an investment. As in the case of the Federal Steel Co., the regulation methods of trust promoters have been adopted, and the Wall Street features of the enterprise have been evidently uppermost. The options on tin plate plants, it is understood, run to Feb. 1, so that there is ample leeway for the perfecting of details. Further meetings of the stockholders are expected in the next few weeks. Meantime the possibilities of hitches in final negotiations are realized, but the trade is acting more and more on the presumption that the deal will be carried through.

A SIGNIFICANT statement from abroad is that the German Union or Association of Makers of Wrought Iron and Steel Pipes has decided to reduce the prices of pipe 30 marks ($7.14) a metric ton, though quotations for most iron and steel products are rising. This action has been taken because offers of large quantities of pipe have been made for delivery in Germany by American manufacturers at prices below those fixed by the union. The German papers are considerably disturbed about the matter, and urge some action to meet this competition, which, according to them, results from the "incredible cheapness" of manufacture in the United States. They do not, however, suggest that an opportunity for competition has been opened by the extent to which the German iron trade is controlled by unions and syndicates, which fix prices at as high a point as possible. The result is that the quotations for export are considerably lower than those for home trade; a condition not unknown in this country also.—[Engineering and Mining Journal.

C. M. Setterwell, one of the leading iron manufacturers of Sweden, is in Pittsburg visiting iron and steel plants.

ELECTRIC MOTORS IN THE SHOP.

"The Electric Motor in Shop and Mine" was the title of a paper by Clarence M. Barber, read in October before the Civil Engineers' Club of Cleveland. Mr. Barber said that the claims made for the electric motor as a desirable power in shop and mine are based on the ease with which it can be applied to almost all purposes for which power is required; economy of installation, the saving of power, and other incidental advantages. The absence of overhead shafting and belting is a great consideration, as these greatly interfere with the use of overhead cranes, which latter have come to be indispensable where heavy work is to be handled. Belts and shafting, indeed, preclude even the use of jib cranes. It is a valuable consideration, in connection with the use of the motor, to be able to place machinery at any angle with the meridian and at any distance from the source of power. Mr. Barber referred to the fact that large punches and shears are sometimes built, with motors attached, so arranged that the whole may be turned on ball bearings about a vertical axis, thus accommodating the machine to any position of the work.

The first cost of electrical installation is greater than that of belt and shafting transmission, but the cost of maintenance is less. The discussion of the relative loss of power in the two forms of transmission showed widely differing data. Theoretically the loss of power in transmission by shafting is small, probably below 10 per cent. Prof. Flather's investigation showed the loss to average 40 per cent in the installations from which his figures were taken. The loss of 80 per cent, which is given for the Baldwin Locomotive Works under the old method which preceded motors, is exceedingly high. Henthorn gives the results of 55 tests in New England shops, with an average loss of 26 per cent. Prof. Fessenden reports 108 cases and arrives at 69 per cent as the average loss. The great variations noted are due to the varying extent of the area over which power is transmitted, to the character of the machinery, alignment of shafting and the amount of lubrication, and to the personal equation of investigators. A fair average, perhaps, is 30 per cent. In the use of electricity there is a loss in the generator, in transmission and in the motor, the total averaging about 23 per cent. Some electrical concerns guarantee that the average plant losses shall not exceed 15 per cent. There are always machines out of use in various parts of a plant, and this fact greatly reduces the capacity of the electrical equipment required to drive them. The time they are idle is a credit to the power plant. The actual quantity of power required is constant, however, within certain limits, and the theoretical requirements in engines and dynamos may be reduced. The plant of the American Lithographing Co., of New York, was cited as an illustration. The total capacity of the engines is 660 h. p.; the generator is 590 electrical horse power, the rated capacity of the motors is 847 h. p., and there are beside 3,000 incandescent lamps and 140 arc lamps. The total generating capacity is only 50 per cent of what it would be if all the machinery was on at once. The average load is really only 17.6 per cent of the rated capacity of all the arc and incandescent lamps and motors, and the maximum only 32 per cent.

The further point was made that electrical transmission is very flexible. Motors with shunt wound fields permit of considerable variation by the rheostat. Once it was difficult to get slow speed motors, but the want is now supplied and now 150- or even 100-revolution motors can be secured in quite small sizes. Recently a great deal has been accomplished in the development of the multi-phase current motor and little remains to make it a competitor of the continuous current machine. Concerning the use of electricity in mining, it was stated that the electric motor early found its way into coal mining and is now used to haul coal to the tipple, and in hoisting and pumping, drilling and under-cutting. The opinion was expressed that an electric percussion drill could be made, but none has yet been produced that fulfills the requirements. The pneumatic percussion drill is at a high degree of perfection and exhaust air from the pneumatic drill is an advantage. But even in this field electricity has its use, and where long distance transmission is included in the problem, is invited to stand behind the pneumatic drill and drive the air compressor.

In the discussion which followed the reading of the paper, Professor C. H. Benjamin, of Case School of Applied Sciences, spoke on the question of economy in the use of the electric motor. He referred to the fact that in nearly every establishment the expense of power is comparatively small, and even a saving of 50 per cent in coal is not a great item. The principal reason for using electricity is that it will increase the output per man per machine. Flexibility is a great advantage—the ability to extend the plant at any time, move any machine at any time, and secure entire freedom from the necessity of alignment. In one establishment to which Professor Benjamin referred, the principal reason for introducing electricity was that cranes might be used

I. H. Sherwood spoke of a shop he recently visited which was using much heavy shafting There were eight long lines of shafting. running from 2½ inches to 4½ inches The shortest line was 50 to 60 feet and the longest 120 feet. The belting was very heavy, one belt being 16 inches wide and 35 feet between centers. A pair of large bevel gears was used to transmit a large part of the power. The surprising fact was that the friction was only about 70 h. p., including the engine friction. After deducting a fair amount for engine friction, there remained only about 35 or 36 h. p. for the shafting friction, or 10 per cent of the total horse power. The chief engineer was very thorough in his work. An assistant went about every month and lined up every bearing. The system and the method of handling the equipment proved a good investment, and while the speaker was called in to advise concerning the installation of electricity he advised the concern to keep what it had.

J. L. Gobeille said that in big machine shops where large machines are run with a motor to each machine, electricity saves power, wear and tear, and danger from fire. Each blower in the Russell foundry at Massillon, O., is run by a motor. The foundry is a long distance from the main building and there is no steam engineering connected with it. Referring to the possibilities of electrical power, he spoke of a wood-working machine driven by a motor making 4,500 to 4,600 revolutions a minute.

Frank Houghton spoke of a plant in Dayton, O., covering four acres and having four or five engines, giving 1,000 h. p. Plans he had assisted in making called for the installation of a generator of 500 h. p The firm doing the electrical work guaranteed to put in free any power beyond 500 h. p. that might be required and the plant was being operated under that guarantee. In connection with the use of electricity in driving twist drills he cited a case at an Amherst, O., quarry. An electrical drill was put in which worked well under an alternating current, except when it was necessary to drill any great length of time. Then the drill would shift to one side and the current was not strong enough to pull it out. On this account the electric installation had to be abandoned. The cost of repairs and of belts he considered no small element in the maintenance of an ordinary transmission plant. One remarkable thing in the efficiency of motors was noted by Mr. Houghton. Take 100 h. p. in an engine and 100 h p in a motor. The efficiency of the motor would be 90 per cent and of the engine, say, 70 per cent. When there is a half load put on the motor its efficiency remains practically the same, possibly within 5 to 10 per cent. When it is down to one-fourth load the efficiency is 40 per cent. In the engine the efficiency at one-fourth load is at zero—it is lost, the whole power being consumed in running the engine itself. This has been shown by a series of tests.

John McGeorge, referring to the respective statements of losses by the two forms of power, took issue with the view that the difference between the 80 per cent loss attributed to one system of belting and shafting and 15 per cent loss attributed to certain electrical installation, should be credited to the motor. An engineer would never dream of putting in such plants as those represented in this statement. The machine shop problem was one that presented wide fluctuations. The machinery in use at one time made a very heavy call upon the electrical installation at one time; again it was very light. He cited a Carnegie plant as a striking example of the advantage of electricity. While there was a total of 4,500 h. p. in motors, they were driven by a generator of 750 h. p. Had steam engines been employed furnishing power direct or through belting and shafting, 4,500 h. p. would have been required. The explanation of the wide difference between generator and motor capacities was that the motors were widely scattered and only a portion brought into service at once.

FEDERAL STEEL CO. PROPERTIES.

The $52,767,500 preferred and $46,484,300 common stock of the Federal Steel Co. has been listed on the New York Stock Exchange. The governing committee announces that there will be listed also $493,400 additional preferred stock when it is issued for shares of the constituent companies. Notices have been sent out to the holders of the trust receipts for stocks of the Minnesota Iron, Illinois Steel and Elgin, Joliet & Eastern Railroad companies that the Colonial Trust Co of New York and the Old Colony Trust Co. of Boston are prepared to deliver the new stock of the Federal Steel Co. in exchange for these receipts.

The statement which the Federal Steel Co. makes to the New York Stock Exchange includes fairly complete reports of the condition of the three constituent companies. The report of the Minnesota Iron Co. is the first ever made public. It is shown that included in the property owned by this company are 39,000 acres of land in fee and 3,320 acres leased. This land is all in the State of Minnesota, and on it are the following iron mines: Minnesota mines, near Tower, on the Vermilion range; the Fayal, Auburn, Genoa, Norman and Canton on the Mesabi range, and the Chandler mine at Ely.

The company also owns the entire capital stock and second mortgage bonds of the Duluth & Iron Range Railroad, the capital stock and first mortgage bonds of the Minnesota Steamship Co. (which owns nine steel steamers and seven steel barges, with a tonnage capacity of 1,250,000 tons of ore per annum), and $\frac{11}{16}$ of the capital stock of the Minnesota Dock Co., amounting in all to $8,785,000. The balance sheet of the company of date June 30, 1898, makes the following showing:

ASSETS.

Property accounts—		
Real estate	$6,569,588.80	
Plant at Soudan, Minn.	343,251.87	
Office furniture and fixtures and private car	7,675.00	
	$6,920,515.67	
Less replacement fund	10,767.30	
		$ 6,909,748.37
Supplies		68,596.01
Investments in securities and advances made		10,448,973.99
Quick assets—		
Cash and cash items	$ 555,493.59	
Bills receivable	133,882.35	
Duluth & Iron Range R. R. 2nd mort. bonds	3,500,000.00	
Accrued interest on bonds	123,525.00	
Suddry debtors	9,227.14	
		4,322,130.08
Iron ore, 353,090 tons	$ 771,374.89	
Less customers' accounts, credits	206,763.29	
	$ 564,611.60	
Customers' accounts, debits	51,706.76	
		616,418.36
Total		$22,365,766.81

LIABILITIES.

Capital stock		$16,500,000.00
Floating debt—		
Bills payable	$ 264,986.11	
Approved vouchers	43,808.40	
Other audited accounts	84,575.22	
Contingent liabilities	12,475.54	
Accrued taxes	2,358.11	
		408,203.38
Income accounts—		
Profit on ore delivered	$ 7,846.99	
Profit on investments	109,111.14	
Interests, accounts	171,879.77	
Rents and miscellaneous	468.00	
	$ 253,611.92	
Less general expenses and explorations	$ 18,402.31	
		255,209.61
Surplus—		
Profit and loss, 1887-96	$ 6,095,790.82	
Profit and loss, 1897	2,594,063.00	
	$8,689,853.82	
Less dividends	3,487,500.00	
		5,202,353.82
Total		$22,365,766.81

The property of the Illinois Steel Co. is described as consisting of the North, South and Union works in Chicago, the Joliet works at Joliet, and the Mlwaukee works at Milwaukee, valued at $20,405,468, together with stock and bond holdings in the Chicago, Lake Shore & Eastern, Chicago & Kenosha, Chicago & Southeastern, Joliet & Blue Island, Milwaukee, Bay View & Chicago and Chicago & Eastern railway companies, aggregating $3,830,000. Following is the balance sheet a of Junse 30, 1898:

ASSETS.

Plants, with the real estate, equipments and improvements	$20,405,468.32
Investment in railroad stocks and bonds	3,830,000.00
Investment in coke property	2,781,000.00
Other investments	419,649.83
Quick assets—	
Inventory of material and supplies	$3,091,333.66
Cash	438,786.33
Bills receivable	365,056.43
Accounts receivable	4,243,048.19
	8,138,223.61

LIABILITIES.

Capital stock outstanding	$18,650,635.00
Five per cent convertible debenture bonds, due in 1910 (entire authorized issue)	6,200,000.00
Five per cent nonconvertible debenture bonds, due in 1913 (entire authorized issue)	7,000,000.00
Non-interest dividend scrip outstanding, due in 1913	85,142.67
Quick liabilities—	
Bills payable	$1,345,000.00
Accounts payable	1,408,285.08
	2,753,285.08
Reserve funds for replacements, etc	211,371.62
Profit and loss	664,907.39
Total	$35,565,341.76

The property of the Elgin, Joliet & Eastern Railway Co., consisting of 180.38 miles of main line and branches, 95.04 miles of spurs and yard sidetracks, 16.35 miles of trackage rights, 50 locomotives, 2,029 freight cars and 3 passenger cars, is all subject to a mortgage of $10,000,000, under which $7,417,000 bonds are now outstanding. The balance sheet of the company as of June 30, 1898, shows the cost of the road and equipment to have been $13,351,526. Since 1897 there has been expended for further construction and improvement the sum of $62,046. The capital stock of the company is $6,000,000, making total capital and mortgage liabilities of $13,417,000.

The net earnings of the Illinois Steel Co., Minnesota Iron Co., Elgin, Joliet & Eastern Railway Co., Lorain Steel Co., and Johnson Co. for the nine months ending Sept. 30, 1898, after paying all fixed charges, are said to have been not less than $3,000,000, and the net earnings of the year ending Dec. 1, 1898, after paying all fixed charges, are estimated at a minimum of $4,000,000. The fixed charges above referred to consist of:

One year's interest, 5 per cent, on $13,200,000 Illinois Steel Co. debentures	$ 660,000
One year's interest, 5 per cent, on $7,417,000 Elgin, Joliet & Eastern Railway bonds	370,850
One year's interest 6 per cent, on $1,600,000 Johnson Co. bonds...	96,000
And in respect of the Duluth & Iron Range Railway Co.:	
One year's interest, 5 per cent, on $6,732,000 first mortgage	336,600
One year's interest, 6 per cent, on $1,000,000 second mortgage	60,000
One year's interest, 5 per cent, on $10,000, land-grant mortgage	500
	$1,523,950

The statement adds that the company owns 30,000 shares preferred stock and 60,000 shares common stock, being the entire stock of the Lorain Steel Co., and 30,000 shares of stock of the Johnson Co., being the entire stock of that company. It is stated that the Lorain Steel Co. and the Johnson Co., owning very important plants, are without incumbrance, except as to $1,600,000 Johnson Co. bonds. In addition to these properties the company will have after completion of extensive improvements, upwards of $9,000,000 cash.

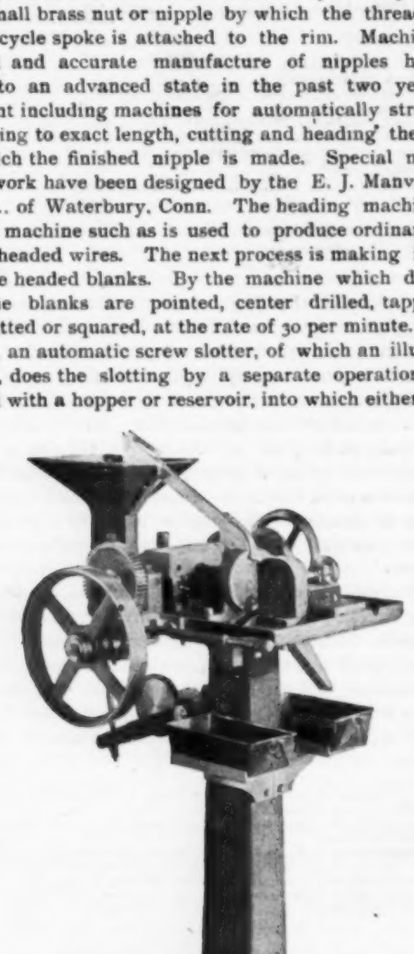
Unusual Shipbuilding Records on the Clyde.

In October, according to English exchanges, the Clyde shipbuilding yards were busier than ever. The output was 23 vessels, including one warship, and the total tonnage reached 45,960 tons. For the ten months of the present year the output amounts to 238 vessels, with a gross measurement of 345,495 tons, which is nearly 40,000 tons more than in the corresponding period of 1896, hitherto the year of the greatest prosperity in the Clyde yards. The new work booked during the month only reached an average amount. An approximate estimate is 25,000 tons, compared with about 30,000 tons last October. The demand for all descriptions of shipbuilding material continues upon a literally enormous scale, and deliveries are being urgently pressed forward. In the Sheffield district the makers of armor plate are particularly busy and are working at their full capacity without being able to do much more than keep level with their contracts. It is understood that the Admiralty is urging for deliveries at greater speed. All branches of the British engineering trade are busy, particularly locomotive builders. Some large contracts are pending for Indian railways, while boilermakers and marine and electrical engineers are busily employed.

THE Wheeling Steel & Iron Co.'s steel plant at Benwood is running full. The present pay roll is larger than at any time in the company's history.

AUTOMATIC NIPPLE AND SCREW SLOTTER.

An important function in the modern bicycle is performed by the small brass nut or nipple by which the threaded end of every cycle spoke is attached to the rim. Machinery for the rapid and accurate manufacture of nipples has been brought to an advanced state in the past two years, this equipment including machines for automatically straightening, feeding to exact length, cutting and heading the blanks from which the finished nipple is made. Special machines for this work have been designed by the E. J. Manville Machine Co., of Waterbury, Conn. The heading machine is a standard machine such as is used to produce ordinary rivets or other headed wires. The next process is making into nipples these headed blanks. By the machine which does this work, the blanks are pointed, center drilled, tapped and either flatted or squared, at the rate of 30 per minute. A third machine, an automatic screw slotter, of which an illustration is shown, does the slotting by a separate operation. It is arranged with a hopper or reservoir, into which either nipples



or screw blanks, to be slotted are placed, and here they are separated and started down the inclined trough shown, at the lower end of which is an intermittently driven dial, having suitable notches in its edge, to successively take blanks from the supply tube and carry them into position so that an adjustable slotting saw may do the work required, the piece in the meantime being firmly gripped. As the dial makes its successive moves, the finished pieces drop and are carried by suitable chutes into the pan at the left, while the saw chips drop into the pan at the right. This machine will slot the heads of brass screws or nipples at the rate of 100 per minute, or may be used for slotting steel screws up to one-quarter inch diameter at about half that speed. Every nipple is finally inspected and all such as are unfinished or imperfectly drilled or tapped thrown out. With the inspector at the slotting machine, every head is plainly visible as it passes down the slide, so that the imperfect pieces may be easily recognized and removed. Thus the slotting costs nothing and the inspecting is done at the rate of 100 per minute.

Pig Iron Casting Machines at Birmingham.

The Laughlin pig iron casting machine, recently brought out by Jones & Laughlins, Ltd., and in use at their furnaces in Pittsburg, is also being installed at the Ensley furnaces of the Tennessee Coal, Iron & Railroad Co. It will serve four stacks, and will be in operation in a few weeks.

Erskine Ramsay, of the Tennessee Coal, Iron & Railroad Co., has received notice of the granting of a patent on a pig iron casting machine he has recently devised. It is different from the Uehling or Laughlin or any other of the machines heretofore patented.

CONDITION OF BLAST FURNACES OF U. S.*

Nov. 1, 1898.

Location of Furnaces.	Coke and Anthracite.					Charcoal.				
	Total No. of Stacks.	In Blast.		Out of Blast.		Total No. of Stacks.	In Blast.		Out of Blast.	
		Number.	Weekly capacity.	Number.	Weekly capacity.		Number.	Weekly capacity.	Number.	Weekly capacity.
New York	11	3	4300	8	6164	2	1	110	1	100
New Jersey	2	1	826	1	942	.....	.....	.....	.....	.....
Spiegel	3	3	546	0	0	.....	.....	.....	.....	.....
Pennsylvania:										
Lehigh Valley	32	7	4705	25	10269	13	1	140	12	610
Spiegel	1	0	0	1	90	.....	.....	.....	.....	.....
Schuylkill Valley	11	6	4480	5	3047	.....	.....	.....	.....	.....
Upper Susqu. Val.	4	2	2118	2	1200	.....	.....	.....	.....	.....
Lower Susqu. Val.	10	4	4252	6	2221	.....	.....	.....	.....	.....
Lebanon Valley	11	8	6325	3	2355	.....	.....	.....	.....	.....
Spiegel	1	1	535	0	0	.....	.....	.....	.....	.....
Pittsburgh	29	26	60360	3	6830	.....	.....	.....	.....	.....
Spiegel	1	1	521	0	0	.....	.....	.....	.....	.....
Shenango Valley	16	9	14493	7	7062	.....	.....	.....	.....	.....
Western Pennsylvania	19	9	11270	10	5294	.....	.....	.....	.....	.....
Spiegel	1	1	700	0	0	.....	.....	.....	.....	.....
Maryland	5	2	2800	3	2970	4	1	125	3	491
Wheeling District	9	9	11799	0	0	.....	.....	.....	.....	.....
Ohio:						9	1	65	8	623
Mahoning Valley	13	9	14198	4	5225	.....	.....	.....	.....	.....
Central & Northern	9	9	12820	0	0	.....	.....	.....	.....	.....
Hocking Valley	2	1	300	1	550	.....	.....	.....	.....	.....
Hanging Rock	12	7	2752	5	1147	.....	.....	.....	.....	.....
Indiana	1	0	0	1	130	.....	.....	.....	.....	.....
Illinois	16	12	23410	4	5573	.....	.....	.....	.....	.....
Spiegel	1	1	1064	0	0	.....	.....	.....	.....	.....
Minnesota	1	0	0	1	629	.....	.....	.....	.....	.....
Wisconsin	4	3	2610	1	910	.....	.....	.....	.....	.....
Missouri	2	1	911	1	650	1	1	343	0	0
Colorado	3	2	2218	1	1000	.....	.....	.....	.....	.....
Virginia	22	10	6817	12	7535	4	0	0	4	417
Kentucky	6	4	1792	2	1530	3	0	0	3	300
Alabama	30	19	19129	11	8360	12	2	661	10	2230
Mich. and Wisconsin	.....	.....	.....	.....	.....	17	7	3403	10	3620
Tennessee	13	6	4934	7	3950	9	2	351	7	2320
Georgia	2	0	0	2	960	3	1	325	2	360
North Carolina	2	0	0	2	600	.....	.....	.....	.....	.....
New England	.....	.....	.....	.....	.....	11	2	250	9	851
Texas	.....	.....	.....	.....	.....	4	1	174	3	700
Utah	.....	.....	.....	.....	.....	1	0	0	1	175
Oregon	.....	.....	.....	.....	.....	1	0	0	1	175
Totals	305	176	222988	129	87783	94	30	5947	74	13941

SUMMARY.

Fuel.	In Blast.					Out of Blast.			
	Number.			Weekly Capacity.			Number.		Weekly Capacity.	
		Month Previous.	Year Previous.		Month Previous.	Year Previous.		Month Previous.		Month Previous.
Charcoal	20	20	19	5,947	5,732	4,656	74	77	12,942	13,426
Coke and Anthracite	176	172	164	222,988	209,903	208,503	129	133	87,783	89,062
Total	196	192	183	228,935	215,635	213,159	203	210	100,725	102,488

*Condensed from the *Iron Age*.

Kennedy Movable Coke Oven.

Tests have been made recently at Cokeville, Westmoreland Co., Pa., of a new coke oven designed by Hugh Kennedy, general manager of the Isabella Furnace Co. The oven is movable and is made of steel, lined on the inside with firebrick, as ordinary ovens are. When coke is ready for discharging the oven can be moved forward from its base and the contents dumped without the aid of manual labor, except the effort required to move the oven, which can be done in a very short time. As the coke is watered after it leaves the oven, no heat is wasted, and the oven remains practically as hot as when the coke is burning within it. The economy consists in the saving of labor in the discharge of the coke and in the retention of the heat, which causes the next charge to fire up more rapidly than when the oven has been cooled off by being sprayed with water as with the present method. This increases the output to such an extent that a less number of ovens will be required for a given output. The operation of the oven was inspected recently by General Manager Lynch, of the Frick Coke Co., Julian Kennedy, Hugh Kennedy and others.

MARY FURNACE, at Lowellville, O., goes in blast this week after a complete overhauling in which it has been considerably enlarged.

Cast Iron.*

BY DR. RICHARD MOLDENKE.

The recent tests of cast iron columns made under the auspices of the building department of New York brought out very forcibly our comparative lack of knowledge and skill in handling a material which should be peculiarly well adapted for this class of work. The practical condemnation of cast iron for even the simplest of structural members under stress is the natural consequence of the uncertainty existing in the mind of the engineer and founder regarding the interior condition of an otherwise good-looking casting.

In carrying out the numerous processes incidental to the preparation of steel shapes, from the furnace to the erecting shop, a continuous watch may be kept upon the behavior of the metal, imperfections detected with some degree of certainty, and such material at once removed. With cast iron, however, we are practically in the dark and must depend upon our best judgment and experience. The reason for this state of affairs lies in the great lack of homogeneity in cast iron, this being all the more noticeable as, unlike steel, it is not subjected to subsequent treatment which, if properly carried out, should remove internal strains and leave the piece amenable to the laws of applied mechanics.

But for the manifest advantages of a material which can be cast into any conceivable shape readily and with a fair chance of success, where would a factor of safety of 20 be tolerated? We are hardly ready as yet to accept machinery built of structural steel as long as the superior stiffness of heavy cast iron frames and beds is not counterbalanced by too great a cost. This, moreover, in spite of the fact that we have to reckon heavily with the internal strains and consequent warping tendencies of large castings in machine design and construction.

The modern tendency is to raise the elastic limit of the materials we work with in order that a saving in weight may be effected. Note the astonishment of European engineers when they see our bridges and structural work in general. They call it airiness, and lack of solidity; we, on the other hand, deal with the highest grade of materials and keep the standards at the top notch. There is wisdom in this economy, for greater care bestowed upon smaller quantities leaves us the more of our natural resources to draw from in the desperate grapple for the world's industrial supremacy. Thus cast iron is being studied more than ever; its strength is being raised by changes and improvements in processes; and there is on the market to-day a range of irons from the brittle sash weights, which utilize all that would be dangerous in important work, up to the finest gun metals, and those irons which approach the regular steel castings in many ways.

By Way of History.

Very little may be said about the history of cast iron. As a matter of fact the rate of progress in our day is so great that we can hardly pause to look back, being fully occupied to keep at least abreast of the times, if we are not fortunate enough to be in the lead. Suffice it to say that the earliest attempts to cast iron as such were made in England and date back to the fourteenth century. As the value of everything in those days hinged upon its availability as an instrument of active warfare, we naturally read of the casting of cannon regularly 200 years later. Our own Carnegie Museum contains two very interesting relics of cast iron made in the days of William Penn. From England the art of casting iron spread over the continent and finally came to America.

Until recently but little attention was given to the general run of foundry work. Iron was very expensive and requirements were not at all severe, specifications being practically unknown. To-day this is different. Competition has put every one on the alert, every point is noticed and the small economies practiced for centuries in the old country are now being thought more of here since the rich cream has disappeared from what was formerly a happy-go-lucky business. To-day we are on the threshold of a more rational system of working, our practical men giving their best efforts to improve molding and casting methods, while the scientific end of the trade is making the production of castings a distinct branch of the metallurgy of iron.

What is Cast Iron?

According to our general understanding cast iron is that form of iron which contains more than 1½ per cent carbon and from its nature can only be cast into molds to be of commercial value. A closer examination shows us some limitations to this definition. A thin bar of ordinary cast iron, under suitable conditions, can be heated in the forge and then twisted, thus showing a property at variance with our intuitive feeling of what cast iron should do. Again, many street railway gears are sold as steel because the teeth can stand considerable punishment before breaking, and yet the iron is only an excellent grade of gun metal which has received the additional benefit of some annealing.

Cast iron in its true sense is, therefore, best classed as that grade of iron carrying over 1½ per cent carbon, which after casting is not subjected to further heat treatment. Thus pig iron is a true cast iron, for the metal as it comes from the blast furnace, if of the proper composition, could be used for the direct casting of certain kinds of work, such as ingot molds. Malleable cast iron, however, is not a true cast iron, for though the casting process is used, the original refining and subsequent annealing, with its radical metallurgical changes, place this most interesting material in a separate class entirely distinct from both cast iron and cast steel.

Materials of the Founder.

We have a variety of cast irons, made by a number of processes. Thus the same metal melted in different ways produces differently constituted castings, with a consequent variation in commercial value. This will be seen more fully in the discussion of the processes.

To look first at the material the founder of cast iron must deal with, we find an astonishing variety, all classes useful in their proper sphere. In general they are the pig irons and the scrap. The scrap may be classified into the foreign (so called because it is bought in the open market) and the gates, sprues, defective castings and the like made by the founder himself, the composition or quality of which he may be supposed to know. In the foreign scrap there are varieties and variations. We have heavy and light machinery scrap, car wheel, stove and miscellaneous scrap, burnt grate bars and the like. The designation usually gives a clue to the quality, which is supplemented by breaking and examining fractures, but taken all in all, without a thorough knowledge of the possibilities of the methods used in mixing and melting charges containing this material, disastrous results are very apt to occur. This is especially the case with the miscellaneous scrap which may contain the remains of many a burnt-out grate bar melted over again, material which should not be taken as a gift when making good work.

The pig irons may be looked upon from the following standpoints. Depending upon the fuel used to make them, they are cold or warm blast charcoal, anthracite, and coke. It would be infringing upon the subject of the blast furnace to go into a detailed discussion. Suffice it to say that anthracite rons are now a rarity and differ little from those made with coke. The charcoal irons are too expensive for use in anything except high class specialties.

The experience of the writer, so far as the relative value of coke and charcoal irons is concerned, runs about as follows: The cold blast charcoal iron is probably the finest variety made, and taking irons of identical composition for comparison the charcoal pig is undoubtedly the better, for the apparent reason that in its preparation the chances of oxidation and consequent weakness have been at a minimum. This point may be disputed, for there is too little known about the molecular constitution of both irons to be positive about any statement concerning them. The fact remains that if the additional safety derived by the proper use of charcoal iron counterbalances the increase in cost, it is to be preferred. To the credit of well made coke iron be it said that this condition exists only in special lines of work.

The second way of classifying pig irons is one rapidly getting out of date, and that is by their fracture. Anyone familiar with the variations in fracture produced by higher or lower casting temperatures would be little inclined to buy iron on this basis. Long experience and familiarity with the

* Read before the Engineers' Society of Western Pennsylvania, Pittsburg, Nov. 15, 1898.

iron may give an inkling to the quality of the metal, just as a steel expert can detect much of value from the fracture of a broken forging, but pig iron must be remelted, and many of its characteristic points seen in the fracture disappear in the casting made from it. The commercial grades of soft, medium and hard, No. 1 to 6; the special grades of foundry, forge, silvery, and mottled irons, as analyzed by a chemist in the shape of an Irishman with a sledge, are being gradually merged into plain pig iron carrying so much silicon, sulphur, phosphorus, manganese, and total carbon.

The range of pig irons, therefore, with which we deal to-day includes those high, medium or low in their constituents other than the iron. For current use it is still convenient to speak of "Bessemer" iron, which for the foundry means phosphorus below .1 per cent, low sulphur and medium to high silicon; "softeners," which mean silicon between 4 and 8 per cent, and "ferro-silicon," which means 8 per cent silicon and above.

The foundry pig irons proper give us the choice between the following compositions: Phosphorus from .07 to 2.00 per cent; silicon, .14 to 3.25 per cent; sulphur, .02 to .5 per cent; manganese, .30 to 2 00 per cent, and total carbon from 2.50 to 4 50 per cent, the proportion of graphite and combined carbon going to make it up, depending entirely upon the heat conditions and the amount of silicon, sulphur, manganese and phosphorus,—important in the order named—which may be present. One can readily see that with the limits above given there may be an endless series of combinations, and when it is remembered that to be able to predict successful results as required nowadays, as well as to obtain them, close attention must be given to this matter, and the lot of that founder who does not believe in chemistry or rather metallurgy in his works will eventually become a hard one.

Processes of Melting.

We come now to the processes for making cast iron. For the production of castings on a commercial scale there are practically only two—melting in the cupola or shaft furnace, and melting in some form of the reverberatory furnace. The use of crucibles for melting may still be found in experimental work and possibly in some remote corners of the earth where civilization has not yet given the inhabitants the means of scraping together more dollars in a given time by legitimate means. Yet this crucible process is the one calculated to give the cleanest iron. We see this by analogy with crucible steel. The open-hearth process can make a material exactly like that from the crucible in composition, yet the latter is so much better on account of its freedom from slag and oxidation. The chemical processes have more time, and the last traces of slag rise to the top.

In the reverberatory furnace, often called the straight draft, we have first the melting down of the charge, the rabbling or poling to mix it well and possibly help to clean it, and the slight refining called for by the work, or else unavoidable while getting the proper casting temperature. It may be taken as a safe rule to let this refining action be as limited as possible, for the change is internal. It burns out the manganese and silicon in the interior of the bath, distributes finely divided slag, and makes dirty iron if sufficient time is not given after tapping to let it clear itself, at best an uncertain proceeding.

To look at the matter more closely we find first in the charging the cause of much subsequent trouble. Where the furnace can be charged while hot, that is, where the scrap is no larger than can be gotten through the ordinary sized doors, it is comparatively easy to arrange melts so that the material easiest melted goes in first and forms a bath for the protection of that charged thereafter. The small scrap would therefore go in first and the pig iron last. To help matters, in case the iron is cleaned before charging slag may be thrown in which when melted forms a protecting coating on the iron and thus partly arrests the refining action of the oxygen passing over it. This coating of slag, however, is by no means a complete protection, for the internal action keeps the bath in motion, fresh particles of iron become exposed through the slag, manganese and silicon are burned out, which uniting with the oxidized iron form slag. If the temperature is high even carbon will go.

Thus it will be seen that there will always be more or less oxidation, with all the troubles that follow, from the very nature of the process, and founders of heavy castings which must be absolutely free from the surface blemishes caused by gases in the iron find this very oxidation one of their worst enemies. The logical conclusion would be to melt as fast as can be done without overheating the charge, and when the iron is properly melted and hot enough to cast let no delay keep it in the furnace subject to the oxidizing influences of the flame. When heavy scrap is to be used and the end of a cold furnace is taken out for the purpose of charging, one can readily see that the troubles of the founder are aggravated if anything, for the time of melting down a given weight is doubled or trebled.

So much can be said of the behavior of cast iron in the reverberatory furnace. The fact that the metal does not come in direct contact with the fuel (in the crucible method not even with the flame) keeps the product purer and hence makes the metal (when good) of high grade, in spite of the unavoidable slight oxidation. Another factor in the comparison of cast iron made in this way with that made in the cupola is the molecular constitution of the respective products. Here we know too little as yet, but this can be said, that a gun cast from refined air furnace iron is undoubtedly better than when cupola metal of exactly the same composition is used. In everyday parlance the last mentioned iron would be judged to be of a "closer" structure than the first, but what that would mean translated into the language of science remains as yet one of the mysteries of molecular physics.

In the cupola process of melting iron we have a direct contact of the metal with the fuel. Under proper conditions the oxidation of the iron itself should be less, for that which is unavoidable falls to the manganese first, this uniting with sulphur and protecting the silicon in some measure, the silicon going next. While, therefore, a cupola charge should contain about 15 per cent more silicon than the castings wanted, when there are high manganese pig irons present, or many scrap car wheels, this loss in silicon may drop to 5 per cent and even less, Carbon as a rule remains stationary and may even go up by absorption from the fuel, 4 60 per cent being about the limit under ordinary conditions. One of the principal sources of danger is the sulphur in the coke. Too much care cannot be given to keep this as low as possible, and many a casting which failed unaccountably may be found full of microscopic cracks due to the absorption of this sulphur by the iron passing over it, resulting in an effect well expressed by the current term "red-shortness," were it steel instead of cast iron.

The bulk of our castings are made by the cheap and convenient cupola method. It is still crude, in spite of many attempts to use the surplus heat now lost. It will fall to the lot of another to go fully into the status of foundry practice, this much being given with the view of showing to what influences the iron in the castings we buy has been exposed before pouring. Much more could be said, but we must pass on to the next subject, which is

The Constitution of Cast Iron.

It is practically impossible to speak of the physical without taking into consideration the chemical properties of cast iron, and vice versa. A casting freshly broken may be either gray, white, in a condition running between the two, called "mottled," or it may be gray in the center, then mottled and finally white at the edges. Again the fracture may show a distinct line separating a gray center from the white chilled rim, as in car wheels and chilled rolls All of these conditions, whether produced naturally or otherwise, are dependent upon the composition and the thermal changes.

Then we have the crystalline structure similarly affected. Thus the crystals at the edge of a casting are usually small, and in the harder irons may be seen arranged in layers perpendicular to the surface, causing planes of weakness at abrupt changes in direction on the part of the piece. The interior of the casting, if thick, has larger crystals and is consequently weaker than the skin. This holds true only if the casting strains in the piece are not excessive, otherwise we may have the casting in a state of tension such that a comparatively small additional load causes it to give way, the true explanation for many a mysterious failure.

To get rid of such casting strains in the production of work

to be finished up true, very heavy cuts must frequently be taken off. We are all familiar with the strains in pulley arms and rims, and it was the writer's good fortune, in a Western mining region, to see an immense sheave for rope haulage which had just been taken out of the foundry to clean up, break at the junction of those spokes with the rim, where the heat of the sun shining on part of the wheel had added the very slight tension necessary to cause the wreck.

Where irons are cast into chills these casting strains are increased enormously, as for instance in making chilled rolls. We have here a thick shell of chilled iron contracting upon a gray interior. The ends of the rolls being smaller in diameter than the body, a period will be reached in the cooling when they solidify, leaving the interior of the roll still plastic if not fluid. The amount of contraction of a white iron from casting to coldness is about ⅛ inch to the foot, while gray varieties show up only half as much, hence we have an enormous pressure exerted upon the interior of such a roll which, according to discoveries made in subjecting small bodies of high carbon cast irons to such pressures, should make it a genuine mine for microscopic diamonds.

In looking at the structure of cast iron as it appears to the eye we have its color run from white to very dark gray. This is a question of the condition of the carbon present. For simplicity we will say that in white iron the carbon is all combined with the iron in some way, in gray iron it is nearly all mechanically mixed with it, and it may be mixed and combined in varying proportions in the irons between the dead white and the extra dark gray. The reason for such an appearance may be looked for in the resultant of three variable conditions, the composition, the casting temperature, and the rate of cooling. As to composition, silicon is the most powerful element acting upon the carbon. Its absence keeps the carbon all in the combined state. As it enters into the composition the tendency on the part of the carbon is to separate out as graphite, this going on until at nearly 4 per cent of silicon the reverse takes place, the iron becoming whiter, though of a different crystalline structure and color, giving the "silvery" appearance to re-melted softeners and ferrosilicons. In these high ranges the property of silicon to replace carbon to some extent gives us lower carbon irons.

As before stated sulphur, manganese and phosphorus have the same tendency to promote the formation of combined carbon, though in a smaller measure. The physical structures are also different from those produced by silicon, notably the difference in the chill line and in the crystallization of the chilled iron due to high or low sulphur with the same low silicon. The casting temperature is of great importance in this connection, the general rule being laid down that the hotter the iron the greater the likelihood to attain a whiter fracture Thus one iron may be white if cast very hot, and gray if cast colder. The rate of cooling comes in here, the thicker the piece the slower it will cool, so that if a wedge were cast of hot iron the thin edge might be white and the thick end gray.

One can readily perceive what a delicate matter it sometimes becomes in casting very heavy work with great variations in the thickness of the sections, to so combine the irons that a composition is obtained which when hot enough to run properly into the thin webs and ribs will not become white or at least not hard enough to cause undue contraction and make machining impossible. The fact that the physical condition of a casting is a resultant of these three variables is often lost sight of by those who write papers and are familiar with the laboratory and of the foundry only. Too much stress cannot be laid upon the absolute necessity of being fully equipped with a practical knowledge of the essentials of founding iron before venturing to advise others upon its metallurgical end.

Micro-Structure of Cast Iron.

If we look closely into the character of the various forms of cast iron as revealed by their microstructure, we find that in the gray irons a polished and etched surface is filled with thin veins of graphite. These are especially distinct when the etching is heavy, and show us that between the crystalline groups of iron there are thin lamellæ of this very weak material. The rupture of a piece of gray iron is therefore along these planes of weakness, and the thin plates of graphito covering the iron crystals hide them from view. A thorough application of the scratch brush will quickly change a gray iron fracture to a white one, though the structure, unlike a genuine white iron, is coarsely crystalline. The application of acids for etching and very weak solutions of chemicals which color the iron and its carbides differently show, moreover, that surrounding these planes of graphite are carbides of iron from which it was evidently frozen out.

The heavy etching necessary to study samples of gray iron makes it difficult to see much; in fact, in the study of steel and iron microscopists deplore the lack of illumination which would allow them to use their highest powers. Here is a problem for the physicist, to furnish a method of illumination something on the principle of the megaphone in sound. Microscopic investigation on iron and steel requires a vertical reflected illumination, as the specimens cannot be made translucent, and oblique reflection promotes incorrect ideas. Can light be so intensified, without undue heating, that we can apply objectives and eye pieces giving us an enlargement of 9,000 diameters instead of only 1,000 attainable at present, with any degree of confidence in the results? Could science only reveal to us a method by which we can see the molecule, what a wonderful stride this would be.

The appearance of the white irons under the microscope is quite complex, the high percentage of carbon in solution obliterating many of the characteristic forms seen in steels. Much is still to be done in this line, and the comparatively high percentages of the various impurities in cast iron should make this an interesting field. One thing is patent, and that is the extreme lack of homogeneity in cast iron. One might say that we have nearly pure iron, iron saturated with carbon in the shape of several carbides, iron saturated with sulphur, with phosphorus, possibly alloyed with manganese and carbon or with manganese and phosphorus, iron with silicon, and so on; all these mixed up in a heterogeneous fashion, though with some pretense of arrangement based upon their relative freezing points, and the rate of cooling fixed by the thickness of the casting and the nature of the mold.

To this comes the additional complication in the existence of all the constituents in two or more forms. Thus phosphorus is present in two very distinct forms in steel, where they can be readily separated by chemical means, and give very different properties as the one or the other predominates. In cast iron, where the phosphorus contents may be up to twenty times the Bessemer limit, one can readily look for puzzling conditions. Again, the positions of these deleterious ingredients have their effects, more especially the sulphides present. Sulphide of iron is weak and brittle. It does not diffuse evenly but rather localizes itself. This may be the cause of some good now and then, for a high sulphur casting is very dense and impervious to gases, though it is not too strong. It would seem that in the contraction after casting the sulphide of iron, which has a low melting point, is forced inward by the outer shell which is setting. This can readily occur if the casting is thick enough, and in fact may save it from detruction, as the giving way of the fluid sulphide eases up the casting strains considerably. In view of the diffusive properties of some sulphides of iron this otherwise highly objectionable impurity may have some use after all. If the veins of sulphide of iron present run along the line of stress applied to the casting in service, its presence will not be noticed specially, but if across it, then a real danger exists. Unless, therefore, special effects are desired, as in ammonia, air and hydraulic cylinders, sulphur had better be conspicuous by its absence.

Segregation and Shrinkage.

Cast iron is subject to two further troubles which have a distinct bearing upon its general behavior. They are segregation and shrinkage. In the first we meet a state of affairs perhaps a little more aggravated than in steel, for the rate of setting of heavy bodies of cast iron is slower, and consequently more opportunity is given to the impurities to segregate and therefore impair the casting. Thus the total carbon in the center of a casting may occasionally be less than in the surface, while manganese and especially phosphorus may be segregated in very large quantities. Indeed, the separating of graphite in cooling is really a segregation.

As the fluid iron sets it first expands and fills the mold, then

s it cools it contracts, the net result being a slightly smalle evolumnar space occupied in the mold. As a direct result arom this contraction the liquid iron is drawn to the setting surfaces, and more fluid metal must be fed in until the whole mass is solid. If for any reason the supply of fluid metal be cut off, as, for instance a thin section in setting cutting off access to a thicker one there are bound to be unsound spots, falled shrinkages, with consequent dangerous conditions The very fact that they are seldom observed on the surface, unless, indeed, so bad that this dishes in, makes the testing of all castings calculated to resist the penetration of water or gases absolutely necessary.

These shrinkage spots are sometimes very beautiful, being lined with a glittering array of many-colored pine-tree crystals grouped about in most fantastic figures. Necessarily white irons, with their great contraction and quick rate of setting, are especially subject to this difficulty, and special means must be resorted to to palliate, if not correct, the evil. The usual way is the application of a chill to the spots most likely to suffer.

We must, therefore, distinguish between the shrinkage in a casting which is internal, and its contraction, erroneously called shrinkage also, which is external, and is allowed for in the pattern. There are some points in this matter which require further study. As a casting cools, the graphite already having separated out, there is a change in the carbon remaining combined, comparable to recalescence in steel. Whether this causes further marked disturbances in the size of the casting is a much mooted question, evidence on both sides being in. It has appeared to the writer that the apparatus used by all those who have experimented in this line was too crude for the delicate observations which must necessarily be conducted. He therefore recommends the use of mirrors arranged to move with the cooling metal, and rays of light reflected from them upon bromide paper moving at a given rate of speed. This, if properly carried out, should give a sufficient enlargement without any friction of moving parts, or absorption of minute movements in the mass of the apparatus.

A further difficulty to which many a failure to obtain sound castings may be laid is the presence of gas in the iron. This manifests itself by coming out at the moment the metal sets. If it can get away through the mold, well and good: if not a smooth walled aggravating hole just under the skin, and often defying detection, is the result. The trouble may be laid to the handling of the furnace or cupola, the use of burnt material, and probably what is least suspected, the tendency of late years to produce pig irons too fast with the resulting liability of oxidizing them slightly.

Melting and Casting Temperatures.

The peculiar shrinkages in iron are closely related to the heat conditions they have been subjected to, this bringing up the questions of fluidity, melting and casting temperatures. In general we may say that the hotter the melted iron the greater its fluidity (and incidentally the shrinkage); that is to say, if an iron which melts at 2,200 degrees F. is heated up to 2,400 degrees before pouring it will be more fluid than if only 2,250 degrees, and consequently be likely to fill up properly very thin sections. Our common experience is that the higher the carbon, silicon, manganese, and especially phosphorus, the greater the fluidity of the iron. Sulphur acts the other way. Moreover, dissolved oxygen, which means burnt iron, takes all the life out of the melt, makes it stick in the ladle, and gives rise to mis-runs, dirty and spongy castings.

It is an open question still why white irons chill so rapidly, making it necessary to lose no time in pouring after tapping, while the gray irons can be transported for miles from blast furnace to converter, or held in ladles pending the ordinary delays incidental to daily work. True, the melting point of white iron is lower than the gray, but there should be about the same rate of cooling in both unless—and this is quite likely—there are chemical reasons to hasten the congealing of the white varieties. The one point which must not be forgotten here is this. After an iron is brought up to its melting point, it takes further heating to melt it, a situation parallel to making water from ice. Thus a white iron must be raised to about 2,100 degrees F. and then requires one tenth of the number of heat units consumed in doing this in addition to melt it. With the gray irons, which melt at only at 190 degrees F. higher, there are more heat units made latent, the total amount for them being about 10 per cent higher. Aside from chemical conditions and a possibility that the freezing point of each class of iron varies somewhat from the melting temperature (matters on which we have no information as yet) this circumstance may help to account for the remarkable length of time a gray iron may be kept fluid; for all this latent heat must be given out before it sets.

As to the melting point of cast iron, it was the good fortune of the writer to contribute a series of observations on a wide range of white and gray irons only last month, thus corroborating by actual trial the daily experience of observant foundrymen. The set of 57 pig and cast irons, with but few exceptions, had no abnormally large variations from ordinary standards, but the range of silicons from .14 up to 3.29 per cent, with their corresponding variations in combined and graphitic carbons, were admirably adapted to bring out the influence of the former to lower the melting point. The two extremes only are given herewith: a white iron which melted at 1,990 degrees F. having 4.20 per cent combined carbon, and a gray one going at 2,280 degrees F., or 290 degrees higher, contained only .13, the balance of the 3.56 per cent total carbon being graphite. To determine properly the influence of phosphorus, manganese and sulphur on the melting point it would be well to take an iron which remains perfectly white at all casting temperatures, and add to it different proportions of these elements while it is in a melted state, casting each resulting mixture at once. In this way, all the carbon remaining combined, a good comparison would be obtainable.

In connection with the molecular structure of cast iron its specific gravity is of some interest. The whiter the iron the higher this will be, for not only does the space occupied by graphite in the gray irons decrease their density, but the very fact that they are gray, when cast under normal conditions, indicates that they may contain up to 3.25 per cent of silicon. Thus the specific gravity of white iron is given as 7.6 and that of gray as 7.0. This difference has its influence in practice, for it is customary and convenient to simply weigh the pine pattern and multiply by 16 to get the weight of iron required to pour the casting. While this does very well for ordinary gray iron casting, the white varieties require a higher factor.

In a number of determinations made by the writer on the specific gravity of cast irons, the upper limit given above was extended a little, results as high as 7.8 being found where a white iron had been cast into chills. Gray irons which were chilled had the specific gravities raised 0.3 above their normal figure, thus showing the difference in density brought about by a change in carbons from graphitic to combined.

Selections of Irons for Varying Service.

The purpose for which a casting is to be used naturally has, or should have, a deciding influence upon the kind of irons selected for making it. The days when anything went have passed and the result has been a very discriminating specialization of the work. In a jobbing foundry this may be taken care of to some extent by suitably mixing the charges in the cupola, but in general we find the best results obtained in shops arranged with their special ends kept constantly in view.

Here are a few varieties which show the flexibility of the general appellation, cast iron: heavy and light machinery castings; stove plate; cylinders, light and heavy for air, ammonia, or steam; brake shoes; car wheels, which have gray centers and chilled rims; similarly chilled rolls; sand rolls, that is, rolls not chilled on their surface; gun metal, which is made in the reverberatory furnace and embraces a variety of sub-divisions; dynamo frame castings, in which magnetic properties are essential; ornamental castings, from radiators to imitation suits of armor, plaques, and even the exact reproduction of insects used as a pattern; pipe fittings; novelty work; hardware and agricultural machinery castings; pipe; plows, with their chilled points; ingot molds; sash weights, the scavengers of the junk piles, etc.

All these materials are produced for the purposes indicated in the classification just outlined, by a proper adjustment of the silicon, phosphorus, manganese, and sulphur contents within the range indicated in the early part of this paper,

and coupled with physical manipulations characteristic to foundry practice. Fortunately where extreme ornamentation is desired strength is no special object, and vice versa. There are, however, sometimes requirements specified which puzzle the foundryman not a little, for instance where great strength is to be combined with ease in machining, amounting to practically an iron which is at the same time hard and soft. Naturally, in this instance a sufficient amount of steel scrap is added to give strength by the reduction of the total carbon, and the silicon is kept up high enough to throw as much of the carbon present into the graphitic state as possible.

The Question of Tests.

The strength of the iron is dependent upon its composition and the physical treatment received until a finished casting. Even afterward the service conditions have a deteriorating effect but little estimated; in fact, a value almost unknown as yet. Cast iron having for practical purposes no elastic limit, the actual breaking tests are better calculated to represent service conditions than is the case for all the other forms of iron. The strength of cast iron as shown by physical tests ranges between very wide limits. Not only will the different kinds of cast iron run far apart, but actually the same iron when cast into various sections shows a distressing lack of homogeneity which makes comparisons the merest guesswork. What methods of testing to adopt, what test pieces to use, etc., is now occupying the attention of several national bodies of men interested in industrial progress, both here and abroad, and the outcome, it is hoped, will be of much benefit to the manufacturers and consumers of iron castings.

The tensile test is one very difficult to apply properly, but gives sufficiently high values to allow a differentiation, having a given size and shape of bar cast under as nearly the same conditions as possible. The tensile strength of cast iron may run from 14,000 up to 35,000 lbs. per square inch, the former being found in soft but bulky castings, and the latter in the highest grade of gun metal strengthened with the addition of steel scrap. Here we see the effect of lowering the carbon in the casting, the strength as a consequence going up. High silicon lowers the strength; phosphorus, when not over 0.5 per cent, which is the safe foundry limit, rather stiffens the iron, makes it pull stronger, but leaves it brittle. Ordinarily castings should run between 17,000 and 20,000 lbs. per square inch tensile strength.

The modulus of elasticity of cast iron varies from 10,000,000 to 30,000,000, showing the utter lack of value of tests made of cast iron unless all the conditions existing at the time are taken into consideration, and preferably all the outside influences affecting the results removed as much as possible. Again, a set of bars of the same cross-section, but of regularly increasing length, when tested showed a regularly decreasing tensile strength, the last actually being one-half as strong as the first. Results of this kind shake one's faith in all tests of cast iron, but this very circumstance makes it all the more important to dive deeper into these mysteries and get more light and those rewards always coming (usually to the other man, however) from patient investigation and study.

The transverse test of cast iron is the easiest to carry out, and with the same cross-section, same distance between supports and the identical method of testing, the records are in some measure comparable. Yet it is idle to wade through elaborate tables giving the modulus of rupture of cast iron calculated to the square inch, when we know that the same iron in bars of the same section, when tested with varying distances between supports, gives hopelessly discordant values when the regulation formulæ are applied. No wonder that the modulus of rupture per square inch for cast iron thus calculated varies from 10,000 to 65,000 lbs. In making transverse tests the load applied to produce rupture as well as the deflection should be noted. Here, also, we have the effect of a moderate amount of phosphorus showing itself in an increased strength and amount of deflection, but it will be noted that this is the case only with a very gradually applied and slowly increasing load, for the slightest shock means an instant break.

The crushing strength of cast iron is, so to say, its strongest point. It varies from 40,000 to 200,000 lbs. per square inch. This test is seldom made, for if the iron is sufficiently strong to come up to all the other requirements, that of resistance to crushing is almost superfluous. Nevertheless, for certain classes of work such as rolls and hammer dies much could be learned in this way, especially when combined with heat conditions.

Impact tests on cast iron are almost unknown, but could be made with considerable profit, though objections were made on the ground that cast iron is never exposed to shock while in service. Once efficient machinery for this method of testing is provided, we shall hear more of it. We now have some vague ideas of the resistance of cast iron to shock from resilience calculations made of bending tests, but these results are empirical and need further extension and study.

A test for the hardness of cast iron would be a desirable addition to our list, and several ingenious methods have been brought out for this purpose. They will fail to be adopted generally, for we again strike the lack of homogeneity in cast iron which will leave the skin harder than the interior, and the cooler portion of the iron while casting softer than the hotter immediately at the gate. The methods of testing hardness commercially will, therefore, remain of local application, each shop requiring such a test getting up its own modification. Careful regulation of the mixtures and casting temperatures should go a great way to make this style of test only desirable in special cases.

There are other tests, such as punching and shearing, for fluidity, contraction, chill, behavior under heat, etc. This much can be said: that the testing of cast iron is in so crude a state as yet that formulating elaborate specifications to cover anything but the most general points is often a positive injustice to the founder, and, moreover, a retardation of progress toward an international agreement on standard methods of testing.

The writer has not dwelt much upon the effects of the various constituents of cast iron when present in large quantities, deeming this subject rather overwritten of late. He begs the indulgence of his audience for any shortcomings in this hasty sketch of a widely diversified but highly interesting branch of the vast iron industry.

Tests of Steel Rivets.

The regular monthly meeting of the Civil Engineers' Club of Cleveland was held Nov. 8, with Past-President Ambrose Swasey in the chair. Present, 26 members and 13 visitors. Mr. Oscar Textor, member of the Cleveland Chemical Society, presented a paper entitled "A Review of Tests on Steel Rivets," which was illustrated by lantern views and a variety of specimen rivets which had been subjected to severe tests. The material experimented upon was basic open-hearth steel. The average chemical analysisis as follows: Phosphorus, .015; manganese, .46; sulphur, .033; silicon, .005; and carbon, .11. The rivets were tested for tensile and shearing strength, also by nicking and bending cold, and for their behavior under the hammer, both hot and cold. Tests were also made to discover crystallization under the rivet head, if any. The results were described as being very satisfactory, and the conclusion was reached that with proper manipulation and attention to temperatures, such steel rivets are fully equal to the best wrought iron rivets and possess a superior tensile strength. An interesting discussion followed, which was participated in by a number of the members and visitors present.

WM. H. SEARLES, Secretary.

S. W. ROYCE & Co., Manchester, Eng., in reviewing the iron market at the beginning of November say: "The Glasgow pig iron market has been somewhat irregular during this month, but prices have advanced about 1s. 1d per ton. At Middlesbrough the tone has been strong throughout; recently a large business has been done, and producers are very fully supplied with orders, and values have advanced some 3s. 3d. per ton since the beginning of the month. The position is very satisfactory, and further advances seem probable. Shipments, however, from Middlesborough during this year up to Oct. 21, are some 126,000 tons less than in the corresponding period of 1897, while shipments from Glasgow show an increase of some 1,200 tons. The manufactured iron trade in the Midlans is moving well; the different departments are well provided with orders, and in some cases prices have recently been advanced."

MR. CARNEGIE ON THE ECONOMIC CENTER FOR STEEL-MAKING.

We have devoted considerable space to recent utterances of Andrew Carnegie. And now comes his address at the banquet given him by the Chamber of Commerce of Pittsburg, Thursday evening, Nov. 10. More than any other of his public utterances since landing in the United States for this visit, it is of moment to the iron and steel world, touching more fully than his other speeches or his interviews, upon questions that concern the present and the future of the iron and steel trade. We make liberal extracts below, and call attention to the significant facts that may be read between the lines, bearing on the negotiations of the Carnegie Steel Co. with the railroads leading out of Pittsburg. Mr. Carnegie's remarks on this point will recall the publications made two years ago about the possibilities of steel works at Conneaut and the later publicity given to the tentative plans for utilizing lands in the Chicago district purchased by H. C. Frick. Particular interest attaches also to Mr. Carnegie's comments on the economic aspects of steel manufacture in the South and the position of Pittsburg relative to the Birmingham and Chicago districts. It will be noticed, too, that Mr. Carnegie speaks more emphatically than he has ever spoken on the futility of the Pittsburg-Lake Erie ship canal project:

When we first began to manufacture iron here, Pittsburg had an advantage of $4 a ton over the East, and of $7 over Chicago. Had iron remained king, the Pittsburg district would have been his throne and the sole seat of his dominion; but steel overthrew his dynasty and now reigns supreme. In the manufacture of steel Pittsburg had at the beginning still some advantage over the East and the West. Coal was the chief factor in the manufacture of iron and was formerly an important factor in the manufacture of steel.

Coke was always, and remains, an important factor in the manufacture of pig iron suitable both for iron and steel, and these were the foundation of Pittsburg's advantages. Science has, however, day by day, steadily lessened this advantage, as less and less both of coke and of coal have become necessary. A ton and a half of coke used to be required to make one ton of pig iron. It is made now with much less than one ton. Two tons of coal were necessary to make one ton of malleable iron, and a ton of steel is now manufactured with one-half a ton. Transportation of coal and coke from Pittsburg to localities indebted to her for their supply cost three times what it does now.

Pittsburg vs. the South and Chicago.

Gentlemen, there is nothing like boldly facing the truth, and I should little deserve the honor you have bestowed if I did not. The materials necessary for producing a ton of steel to-day can be delivered as cheaply at points in the South as in Pittsburg. I presume many will be surprised, and especially those interested in the South, when I say only as cheaply. They would hold that Alabama will have a decided advantage over Pittsburg in the cost of producing a ton of steel. Nevertheless, I am not disposed to change what I have said. Manufacturers of steel in Alabama make very cheap steel on paper, but they have only made it there yet. There is no reason, however, why they should not succeed in their present effort. They count everything at actual cost, all coal, coke, iron-stone and lime delivered, without interest, depreciation or profit.

Well, if Pittsburg manufacturers were so inexperienced as to count in this way I have seen no figures which Alabama can reach which Pittsburg need be much afraid of. In the East, Pittsburg has nothing to fear. Steel cannot be manufactured on the Atlantic seaboard under any circumstances in competition with her. I believe that it is in the region known as the Central West, extending from Wheeling to Lorain, of which Pittsburg is the center and headquarters, that iron and steel in the United States are chiefly to be made.

There is not a district in this world to which the Pittsburg district cannot to-day send steel and pay the freight and deliver that steel as cheap or cheaper than it can be made at the point of delivery, if we except Colorado, to which the freight is greater than the difference in the cost of manufacturing at the two points. Should the South be successful in its present attempt to manufacture steel, we may have to except another point. Colorado excepted, the Pittsburg district has the whole world to-day at its feet. Pittsburg is indeed the steel city.

Some years ago, you may remember, I stated that Chicago had become a formidable competitor with Pittsburg, even in steel. For reasons to which I shall refer later, she has become less so. The progress of science year after year, as I have said, operated for some years to the disadvantage of Pittsburg relatively with her distant competitor. In recent times, however, the tide has flowed somewhat in favor of Pittsburg, and is in my opinion destined to flow still more freely. The coming census is to show that the progress of our country has been greatest neither in the extreme East or West, nor in the South, but in the great central States and along the lakes.

It is not the manufacturing concerns either in the East, West or South which are, as it were, upon the edge of this increasing mass, which occupy the most favorable position, but those situated in the center, of which Pittsburg is the hub, the center city, round which innumerable consumers of materials cluster. Statistics of last year's production of iron and steel prove that it is this great central district which is developing by leaps and bounds, and not the regions in any other direction. In several instances, concerns have removed from the East and West to this district, giving as their reason the obvious one that this was the best point for distribution.

I believe Pittsburg to be the best distributing point in the United States. She sits here, with one wing covering the East, the other the West, her beak dipping into the lakes upon the North, and her tail flapping in the Gulf of Mexico on the South. All points of the compass are within her easy reach and all tributary to her. She has that surest element of all for success, an enormous home market for her raw products and the largest army of the most efficient skilled labor in the world. Iron and steel go into a thousand things in this busy hive, and she is the city of all others which can indulge in that not very profitable, but sometimes highly necessary action, known as "dumping her surplus." The manufacturing city or nation which can dump its surplus upon other cities and nations has no cause to fear its future. I have spoken only of steel, which is the basic article. The city or the nation which can make the cheapest ton of steel has insured supremacy, the cost of so many other articles depends upon the cost of this prime element.

You can imagine the pleasure that a Pittsburger has in London when he sees the electric roads equipped from Pittsburg, even the cars American, and, more wonderful still, the mighty engines. But, speaking about engines, isn't it strange that this center of blast-furnaces must send to Milwaukee for the best engines? When the Duquesne furnaces required several hundred thousand dollars' worth of engines, and it was proposed to go outside of Pittsburg, I said, "Why not from Pittsburg?" Alas! They were not to be had here. We have been ordering engines since, time after time, and each time I have inquired, "Why not from Pittsburg?" The same answer is returned, "If you want such engines as we need, they must be obtained either in Philadelphia or in Milwaukee." Of course, gentlemen, we cannot do everything, but we might do this. We furnish the steel from here to make this machinery —why not have the best engine-builder in the world here? I wish Westinghouse could add this department—somebody should do it. . . .

Prepared to Build Other Steel Works.

You are aware that we ventured upon obtaining a railroad to the lakes, which, in its progress northward, bisects three great east and west trunk lines, which are thus made factors in the situation. Gentlemen, this was a necessity for Pittsburg; if she were to hold her own with the northern part of the great central district, she had to become a lake port. We have 400 acres of land upon the lake shore at Conneaut harbor, upon which we might have been compelled to erect works to hold the trade—which we do not mean to lose—had we not been able to procure this highway.

Had the Pittsburg railroads not changed their policy, we should probably to-day have been erecting works upon land which we have in Chicago. We need do nothing now since Pittsburg is to receive fair treatment from her railroads. We know Pittsburg to be the best place to manufacture under equal rates, and here we are, and here we remain.

May I suggest to the Chamber of Commerce that great benefit would accrue from the appointment of an able transportation man, one of the cleverest who can be found, whose duties should be to take such measures as will secure statements of every special freight rate and every rebate made by railroads in other districts, that these may be shown to the railway officials here to induce them to protect interests which are mutual, for the growth of manufactures in Pittsburg means prosperity to its railroads. You have only to bring home to your railroad agents here facts of which they may be ignorant, but which none of them can learn without compunction, culminating in the resolve to give Pittsburg justice.

Touching the all-important matter of transportation leads me to refer to my connection with the project for making Pittsburg a lake port by water communication. It has been pointed out that I was the first to suggest in a speech to the legislature that the abandoned canal should be replaced by a deeper one which should lead the waters of Lake Erie into the Ohio. Conditions have changed. Such has been the progress of railway development that, if we had a canal to-day from Lake Erie through the Ohio valley to Beaver, and it was opened free of toll like the Erie Canal, we could not afford to put boats upon it. I have never concealed my opinion that even if we had a 15-foot ship canal, the large lake steamers would not come to Pittsburg. It takes a steamer carrying 7,000 tons of ore to live at present rates—within five years, the lake carrier will be of 10,000 tons, and it will be much cheaper to transfer its cargo at the lakes into smaller boats than to attempt to send the monster through the canal. But more than this, it is cheaper to-day to transfer the ore to 50-ton cars and bring it to our works in Pittsburg over our railway than it would be to bring it by canal.

I do not wish to appear even by silence to be considered a party to any attempt to entice private capital to invest in building a canal between Pittsburg and the lakes, because I am convinced that this capital would be entirely lost; if the canal were completed the existing railroads could and would perform the service cheaper and more satisfactorily, because all the year round. I hold the canal must be a government or a municipal work, built to insure cheap rail as well as cheap water transportation, not to earn dividends. It should resemble the Louisville Canal, or the Monongahela slackwater in this respect.

FIRE BRICK FOR COKE OVENS.

J. B. Hammond, treasurer of the Reese-Hammond Fire Brick Co., of Bolivar, Pa., writing in reply to inquiries from Fred. C. Keighley, superintendent of the Oliver Coke Works, Oliver, Pa., who sought the data for publication, gives interesting information as to the styles and dimensions of ring wall brick, crown brick, tile, jamb and arch blocks, etc., used by various coke manufacturers. Mr. Hammond's letter shows that there is a great diversity in the size and shape of oven brick in use by various coke manufacturers. Some general observations made by Mr. Hammond on the manufacture of brick for this service are worth quoting:

"In the manufacture of a strictly high-grade coke oven brick, practical experience has fully demonstrated that the theory on which they were made 20 years ago has been long since exploded. It was thought in the early days of coke making that any kind of a brick was good enough for a coke oven brick, but many manufacturers to their sorrow were obliged to rebuild their ovens within a few months after they were erected. In the manufacture of a lining brick it should be made of a good refractory fire clay of such mix as not only to resist the heat and water, but also a considerable amount of abrasion. It should be well burned hard, but not vitrified. Crown brick should be made of carefully selected flint clay, as free from iron as possible, with not more than three per cent impurities, and the mix should contain only enough plastic clay to make perfect bond. The flint clay for crown brick should be high in silica. We give below the analysis of the flint clay that we have found to give us the best results in crown brick:

Loss on Ignition	9.12
Silica	63.81
Alumina	20.39
Ferric Oxide	1.23
Lime and Magnesia	*
Total	100.55

*Traces only.

"This flint, with just enough 'plastic' to form a perfect bond, ground in wet pan, ground coarse or so as to show flint clay to range from a fine particle up to pieces ⅛ inch in diameter, but clay ground too coarse does not give as good results as a happy medium. Brick made of this class of material should be hand-molded and hand-pressed, so as to make them uniform in density and give them smooth surface, straight edges and square corners, so as to require the smallest mortar joint where the oven is always weakest; with proper care in the construction of the oven and the use of fire clay to lay them in, of the same quality as the brick, or if not fire clay, the very best quality of loam. Brick made as above stated, with proper care in the construction of the ovens, will give better results, will last longer and drop less in the oven than brick made of any other material that is now known to the business. A peculiar characteristic of clay of the above analysis is that it is not only a great heat resister where the temperature reaches as high as 2,500 degrees in coke ovens, but also possesses the characteristic of standing that more severe test of frequent and sudden cooling when at such high temperature. There is a great deal said about brick in the crown of a coke oven not being affected by the stream of water that is turned on it, but this is a mistake. Any brick will be seriously affected, if by the carelessness of the coke drawer he turns the stream of water on the brick instead of on the coke, but the steam arising from the water in the oven, together with the coke cooling, is together a very hard test, and too much care cannot be exercised in handling the hose.

"The jamb and arch blocks and rings should be made of the very best material. What might be a good mix for one manufacturer, however, sometimes proves bad for another, so that the best results on this class of shapes can only be secured by long experience and close attention to the subject. They should not only contain the best of flint and plastic clay, but also a good percentage of calcined clay, the amount being determined by actual experiment in the percentage of calcined that will be best taken up by the two crude ingredients. While the brick and blocks that enter into the construction of a coke oven should be made of such materials and mixes as to produce a hard, yet porous brick, yet at the same time they should not run when subjected to a high heat, and not break when subjected to quick cooling.

"The bottom tile should be made of such combination of materials and by such process in the manufacture and burning as to make it stand the greatest possible amount of abrasion, and yet not break or crack by the heat or water."

Improved Hydraulic Bending and Forming Machine.

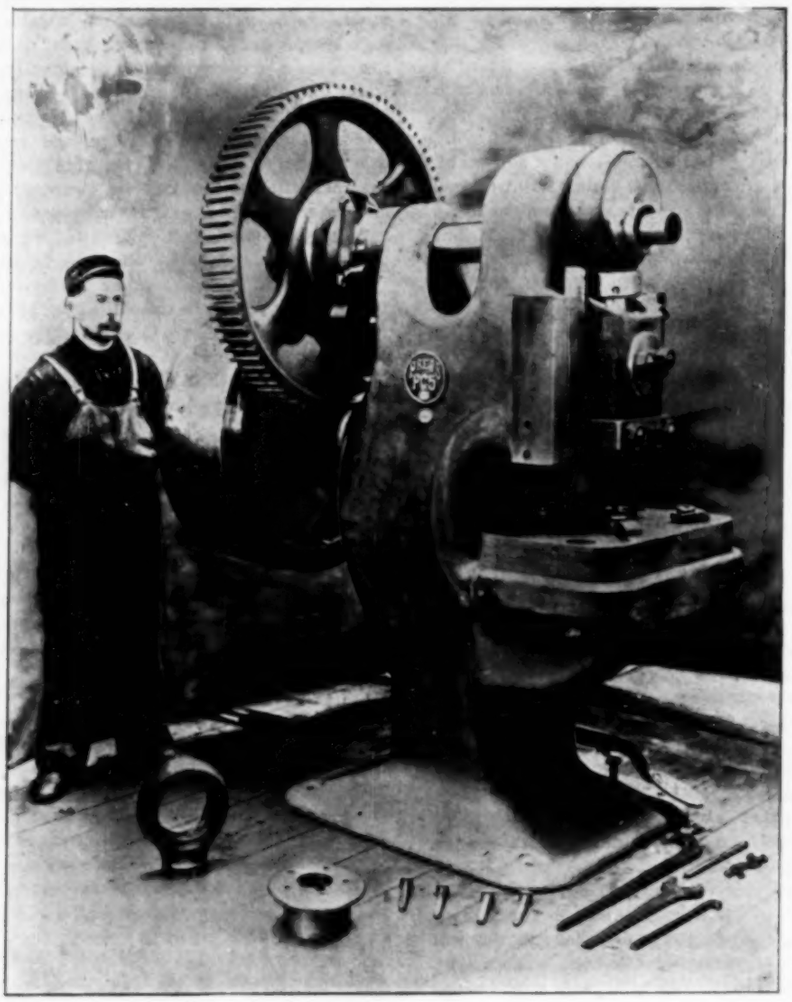
The W. J. Clark Co. has completed and has now in operation in its extensive plate and sheet metal working plant at Salem, O., a new and greatly improved hydraulic bending and forming machine for making boxes and other similar work of plate metal of any gauge from $\frac{1}{32}$ to ¼ inch thickness. The machine makes bends of circular or angular shape, forms a bead or puts wire or rod of any size in the edge of plates and does a variety of work not heretofore done by a single machine in as heavy plate.

In the nine months ended Sept. 30 the record of the exports of manufactured goods from the United States was broken. The amount of exports of manufactures was $227,822,045. Exports of agricultural implements were $8,184,331, against $4,845,927 in the corresponding nine months of 1897. Exports of carriages, cars and bicycles were $8,705,049, against $4,826,080 in 1897. Exports of cotton cloths increased from 234,710,633 yards to 241,166,079 yards, and other manufactures of cotton from $2,878,364 to $3,062,682. Exports of manufactures of fibres and textile grasses were $2,058,130, against $1,719,907 last year; manufactures of leather, $16,382,566, against $14,914,781. The total exports of manufactures ($227,822,045) compare with $212,357,671 in the corresponding nine months of 1897, $184,807,004 in 1896, and $145,793,834 in 1895. Total exports of products of agriculture were $571,294,955, against $466,635,349 in 1897, $416,364,411 in 1896, and $355,977,906 in 1895.

W. B. Pollock & Co., of Youngstown, O., were the successful bidders for the plate work for the new blast furnaces of the Ohio Steel Co. at Youngstown, O. The contract involves approximately $100,000.

HEAVY PUNCHING PRESS.

The illustration is of a machine designated as press PG5, built by the Ferracute Machine Co., Bridgeton, N. J. The frame of the press is hollow, and of very rigid proportions, having the tensible and compressive members of those parts which act as a beam, arranged with internal ribs. This construction gives great rigidity against torsion in the upright part, back of the throat, so that the upper die is not easily sprung laterally away from true alignment with the lower one. The ram is unusually heavy, and is arranged with very long and wide bearings; an extra long pitman graduated to hundredths of an inch, proper arrangements for clamping various kinds of punches, a perfect knock-out when desired, etc. The bolster can be made with various sizes of central hole, and is provided with die-clamps, adjustable in tee-slots upon the face. The shaft is of forged steel, with unusually long and large journals. A new form of automatic stop-clutch



HEAVY PUNCHING PRESS.

is provided, the parts of which are of steel, hardened and ground. This clutch is provided with a safety lock which, while performing other functions incidentally, can be manipulated so as to prevent the press from starting while dies are being set, etc.

The features of this machine are its carefully proportioned parts, great weight and inertia in those submitted to heavy stresses, absence of external ribs, cut gearing, hardened bolts and nuts of large diameter. The dimensions are as follows: hole through the bed, 12 inches by 14 inches; throat, from center of ram back to frame, 10 inches; height of bed to ram at top of stroke and adjustment, 10½ inches; standard stroke of ram, 1½ inches; adjustment of ram, 3 inches; thickness of iron punchable with 1-inch round dies, ⅞ inch; pressure safely exerted by the ram, 68 tons. There are six sizes of this style with gearing, and six sizes without gearing. They are in demand for cutting, shearing and punching bar iron, etc., for heavy sheet-metal forming work and for other service in hardware and bicycle factories.

A "MIDGET" GENERATING SET.

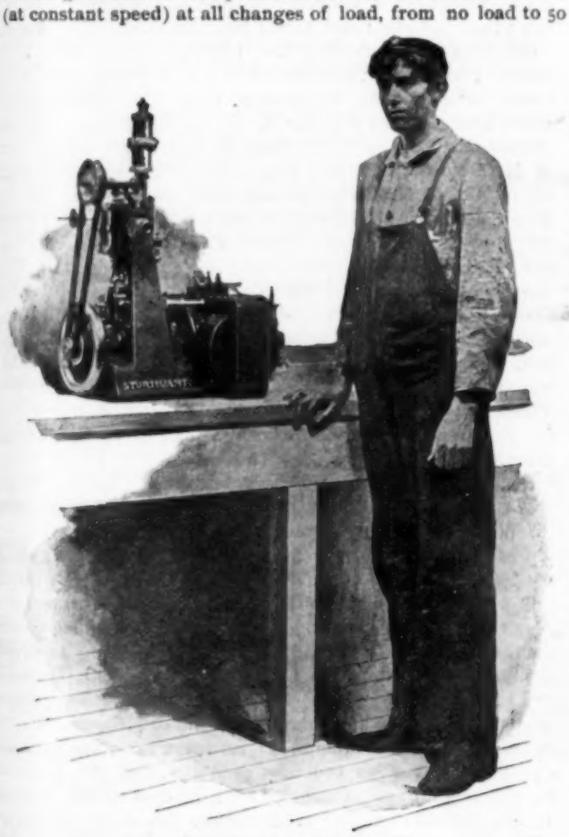
The "Midget" generating set is probably one of the smallest and most perfectly designed of direct-connected machines ever constructed. The view we give is from one of a number recently built by the B. F. Sturtevant Co., of Boston, for the U. S. Navy, to be used in torpedo-boat service. The features of the design are reliability, low temperature, good regulation, ability to stand continuous overloads, a minimum of attendance, high weight efficiency and great compactness. This generating set was designed to be able to develop its rated output continuously with no sparking at the brushes and with a temperature rise not to exceed 60 degrees F.; while the total weight of the engine and dynamo complete ready for steam pipe was limited to 500 lbs. for a rated capacity of 1.5 k. w. The speed adopted was 1,000 r. p. m., and as the engine weighed 150 lbs. complete, the weight of the dynamo could not exceed 350 lbs. In the finished design of the generator this weight was reduced to 250 lbs., of which 75 lbs. was the weight of the armature complete, making the weight of the entire set only 400 lbs.; that is, 100 lbs. inside the limit. Its diminutive size is emphasized by comparison with the figure of the machinist. This brought the weight efficiency of the output complete to 0.266 lbs. per watt output at rated capacity.

To insure steadiness in running, as well as to economize in head room, the center of gravity was kept as low as possible by the adoption of the consequent-pole type of magnetic circuit, giving a four-pole field with only two field coils, and the coils being placed on the horizontal pole pieces reduce the height of the frame and consequent height of the shaft center to a minimum, while rendering a sub-base unnecessary.

The field magnet consists of a wrought iron forging to which are bolted the horizontal pole pieces. The armature is of exceptionally large diameter, to facilitate ventilation and present

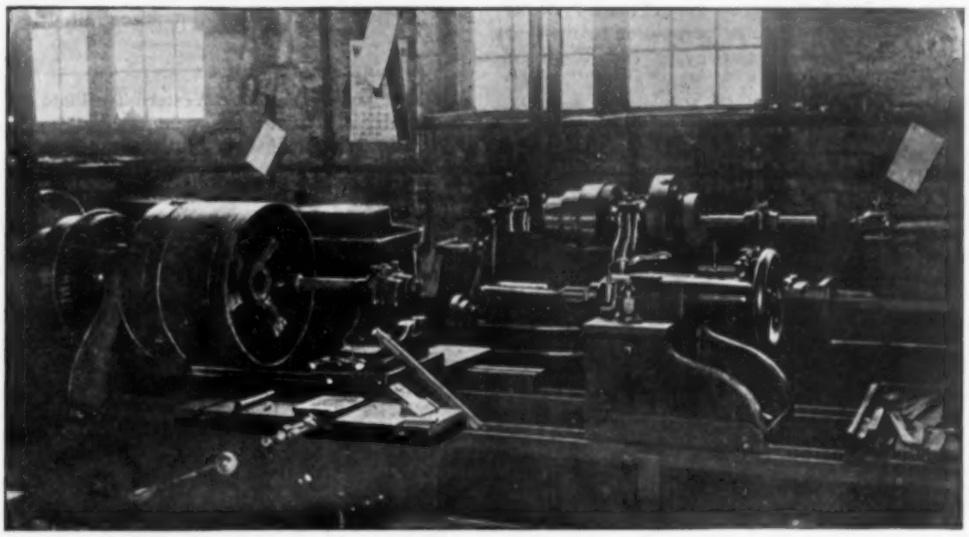
as great a radiating surface as possible. The ventilation of the core is facilitated by means of air ducts placed in the center and at each of its ends. The air ducts consist of a series of radial vanes which when rotated act as a centrifugal blower. As the back end of the spider is completely closed and oil-proof, all the air is drawn through the commutator, which is of skeleton construction and also of large diameter. The brush holders are of the reaction type, two only being used, as the armature is of the two circuit, four-pole, barrel-wound type without cross connections. The brush yoke is supported by a projection from the out-board bearing.

The generator is compound-wound for a constant e. m. f. (at constant speed) at all changes of load, from no load to 50 per cent overload and can stand this variation without sparking at commutators or any movement of brushes. A continuous overload of 25 per cent can be carried with safety. The weight efficiency at the rated output is remarkable, considering the amount of overload that can be carried and the low temperature rise.



A "MIDGET" GENERATING SET.

The engine upon which the effectiveness of the combination depends is of special construction, designed to form a symmetrical part of the whole machine. Its single cylinder is 2 inches diameter by 2-inch stroke, all parts are provided with continuous oiling devices, the bearing surfaces are large and carefully finished, and every feature essential to sustained operation at 1,000 revolutions per minute has been introduced.



BAILEY LATHE ATTACHMENT.

BAILEY LATHE ATTACHMENT.

That the ordinary tools employed for doing boring and other similar work in the modern engine lathe are not entirely satisfactory, is evidenced by the fact that those having much work of this character have resorted to other more rapid and accurate means, notably the monitor turret lathe. However, this type of lathe not, being adapted to general lathe work, is not frequently found in general job and contract shops, as the latter do not have a sufficient amount of this class of work to warrant the investment. The accompanying cut shows a device recently patented by J. A. Bailey, of Atlanta, Ga., designed to overcome this difficulty. It consists of an attachment arranged with tool-holding sockets to be fastened to the tool rest of any ordinary engine lathe in the manner shown. The outer walls of the sockets are split and screws arranged for clamping the tools held therein, at any part of their length. A key or feather is set in each of the sockets to prevent the tools from turning. The base of the attachment is provided with a tongue that fits closely into the groove on the top of the tool rest. By the use of double-tongued plates, one of which is shown attached to its base, one of these attachments may be easily applied to any number of lathes, regardless of difference in size of their tool rests. The sockets are arranged to receive boring bars and such other tools as are used in the turrets of monitor lathes. Equipped with one of these attachments, it has been demonstrated that a lathe can do work usually done on the boring mill, and in many cases can take the place of a turret lathe.

A Strong Pig Iron Situation Abroad.

British pig iron markets are strong, as is indicated by the weekly reports in our English contemporaries. A decrease of 72,440 tons in the amount of pig iron in the different public stores on the West Coast, in Scotland, and in Cleveland, is noted for the present year, and the total quantity of iron so held on Nov. 1 being 585,741 tons, of which 323,015 tons were in Connal's store at Glasgow. This is considered a satisfactory record, in view of the large production of pig iron during the current year. The present output of pig iron, and especially of hematite or Bessemer pig iron, is on an exceptionally large scale, and prices are good. Nevertheless, the rise in the cost of raw materials keeps profits under, and English authorities say is apparently likely to continue to do so.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

Citizens of Akron, O., are making an effort to raise funds needed to locate the Worman-Schub Bicycle Co., of Chicago, and to take it over by a new company to be known as the American Cycle Co. W. H. Carter, assignee of the J. F. Seiberling & Co., Akron, has been granted permission by the court to lease the plant to the new company, in case it goes to Akron.

The R. K. Bland Machine Tool Co., Cincinnati, has been incorporated with capital stock of $50,000.

The city of Cleveland will open bids Nov. 25 for four water cylinders and for repairing and rebuilding a Worthington pumping engine at the Division street pumping station.

The Foster Coupler Co., capital $100,000. will manufacture couplers in the plant of the Whitley Malleable Casting Co. at Muncie, Ind. The directors are Charles Foster, Albert M. Fox, C. E. Lambert, of New York City; James Boyce and Carl Spilker.

New Construction:—

It is reported that the Illinois Steel Co. will build a new foundry 500 feet long at South Chicago. The electrical plant now under construction at the South Works will be completed in a few weeks.

A new wheel foundry will be built by the St. Charles Car Co., of St. Charles, Mo.

Decker & St. Clair, general contractors, have let the contract for furnishing the structural iron work in a new church building in Winsted, Conn., to the Berlin Iron Bridge Co., of East Berlin, Conn.

The visit of Collis P. Huntington to Newport News, in company with A. MacKay, of Scotland, and John Crossley and James Dunn, of London, has revived the report that an ordnance and armor plate plant will be established at that point. President Orcutt, of the shipbuilding company, and the gentlemen named called on Secretary Long recently and this has added color to the report.

A new $40,000 grinding shop is being erected by Deere & Co. at Moline, Ill. A foundry is under way, also.

At Valley Junction, Ia., it is announced that plans have been prepared for new car shops for the Chicago, Rock Island & Pacific. The plans call for a car repair shop, 400 x 210 feet, a car building shop 320 x 150 feet, a foundry 150 x 160, and a paint shop, to cost about $150,000. J. B. Kilpatrick is master mechanic, Valley Junction.

The Cleveland Twist Drill Co.'s new shop, Cleveland, will be 40 x 280 feet and four stories. The equipment includes boilers, pumps and special tools.

Contracts have been let by the Alabama Steel & Shipbuilding Co. to the Schiffler Bridge Co., of Pittsburg, for the erection of a boiler house, a mill building and other work which is to be done around the new steel mill.

The Pettit Ornamental Fence Co., Philadelphia, has begun the erection of a plant at Ambler, Pa.

The United States Water & Steam Supply Co., Kansas City, Mo., will build a new machine shop.

McKeesport, Pa., capitalists are arranging to build a steel plant at Port Angeles, Washington. H. H. Swaney and Geo. Smith are interested.

The Adolph Leitelt Iron Works, Grand Rapids, Mich., are being rebuilt. The new work on the boiler, pattern and machine shops, to repair fire damage, will cost $7,000.

A boiler house 50x50 feet, new engine and new boilers, with additional transmission equipment, are being erected at the plant of the Bristol Brass & Clock Co., Bristol, Conn.

It is expected that the new dry dock of the American Steel Barge Co., at West Superior, Wis., will be pushed to completion immediately after the pending meeting of the directors. The new dock is to be 680 feet long on the keel blocks, 65 feet wide at the bottom and 118 feet at top, with a 65-foot gate. There will be 22 feet of water over the sill. Of late the company has been going into a variety of structural work other than ship building. Work of this kind includes 10 large refuse burners for saw mills, a large number of legs for ore shippin docks and the steel work entering into piers at Duluth. It is also the intention of the company to undertake bridge work.

Additions, Enlargements, Removals, Etc.:—

Enlargement of the Braddock, Pa., plant of the American Steel & Wire Co. is planned, and four acres of additional land has been purchased. About $200,000 is to be expended.

The Fuller Mfg. Co. is about to move from Kansas City to East Moline, Ill., and will build a foundry and other buildings for the manufacture of its disc grain drill.

Fires and Accidents:—

The plant of the Great Western Tin Plate Co. at Joliet, Ill., burned, Nov. 10, with a total loss. The insurance is but $47,500. The plant will be rebuilt, it is said.

The forge shop of the American Ordnance Co., which is in a portion of the General Electric Co.'s plant, at Lynn, Mass., was partly destroyed by fire Nov. 7; loss about $10,000.

The Philadelphia Metallic Co.'s plant at Coopersburg, Pa., burned Nov. 4. Loss on boiler, engine, pulleys, shafting, etc., was $10,000, covered by insurance.

The Columbus Skein & Iron Works, Columbus, O., manufacturers of vehicles keins, post hole diggers and iron and steel specialties, sustained a loss of $20,000 to $25,000 by fier, Nov. 7. Insurance, $7,000.

The foundry of J. A. & P. E. Dutcher at Milwaukee was damaged $1,000 by fire.

A fire at Lorain, O., Nov. 8, destroyed the Lorain Steel Co.'s roundhouse and two locomotives. Loss $20,000.

General Industrial Notes:—

Cochrane separators have been sold recently by the Harrison Safety Boiler Works, of Philadelphia, to the following firms: Geo. V. Cresson Co., Philadelphia, 7-inch horz.; Compania Cervecera, Toluca, Mex., 6-inch horz.; Ashland (Ky.) Steel Co., 4-inch horz.; A. A. Sanborn, Boston, Mass., 10-inch horz.; Johnstown & Gloversville Gas Co., Gloversville, N. Y., one 3-inch and one 4-inch horz.; Braman, Dow & Co., Boston, 3-inch horz.; Simonds Mfg. Co., Chicago, 5-inch vert.; U. S. Navy, 4-inch horz.; Standard Oil Co., Whiting, Ind., three 6-inch oil-ammonia; Williamson Bros. Co., Philadelphia, 4-inch horz.; Boston & Maine R. R., two 6-inch horz.; Massachusetts Institute of Technology, Boston, 8-inch horz.; Wm. M. Hall, North Attleboro, Mass., one 4-inch and one 5-inch horz.; Robert Megowan, Philadelphia, 7-inch horz.; Jos. L. Ebner, Vincennes, Ind., two 6-inch vert.; Barr Pumping Engine Co., Boston, 5-inch horz.; Beaver Traction Co., Beaver, Pa., one 12-inch and one 5-inch vert.; Geo. F. Blake Mfg. Co., Boston, 4-inch vert. and one 3-inch vert.; Shenango Valley Steel Co., New Castle, Pa., 12-inch horz.; Hoopeston (Ill.) Electric Co., 6-inch horz.; Southern Electric R. R. Co., St. Louis, Mo., 12 inch horz.; Hezel Milling Co., East St. Louis, Ill., 7-inch horz.; Chicago Brass Co., Kenosha, Wis., 6-inch vert.; Thompson Bros., Philadelphia, 4½-inch and 10-inch horz.; Mystic(Conn.) Electric & Gas Light Co., 5-inch vert.; Hooven, Owens & Rentschler Co., Hamilton, O., 4-inch vert; Sears, Roebuck & Co., Chicago, 8-inch vert.; Larkin Bros., Ellsworth, Kan., 6-inch horz.; De La Vergne Refrigerating Machine Co., N. Y. City, 5-inch horz. oil-ammonia.

The Detroit Copper & Brass Co. has brought suit against the Enterprise Mfg. Co., of Akron, O., manufacturer of luminous goods, saddlery specialties, etc., for the appointment of a receiver. It is alleged that E. F. and E. A. Pflueger, who own the concern have disagreed, and are seeking to divide the business. Plaintiff as a creditor, says it will lose what is due it unless the court interferes. W. J. Hart was appointed receiver by a Cleveland court, with bond of $100,000.

The Wabash has ordered 50 furniture cars; the Southern Pacific has placed an order for 1,000 cars, and the Atchison for 250 freight cars. The order for 1,000 cars for the Wisconsin Central will be settled at Milwaukee this week. Northern Pacific is considering buying more freight cars. The 500 cars for the Missouri, Kansas & Texas will be built at Sedalia. The Pittsburg, Bessemer & Lake Erie is considering 750 flat-bottom steel gondola cars of 80,000 pounds capacity and 350 pressed steel hopper gondolas of 100,000 pounds capacity. The Canadian Pacific is building 300 box and 60 ore cars. The Baltimore & Ohio has ordered 25 engines.

This Letter Should Interest Many People:

SAN ANTONIO STREET RAILWAY COMPANY,
SAN ANTONIO, TEXAS.
W. H. WEISS, ... President.

MR. JOHN G. HUNTER, Dallas, Texas. August 30, 1898.

Dear Sir:—We are pleased to be able to tell you that the 700 h p. Cochrane Exhaust Heater sold us about six months ago, has been in continuous use since installed, and with very satisfactory results, both in freeing our feed-water from lime and magnesia, with which it is heavily impregnated, as well as the saving in fuel secured through its use. We have no difficulty in heating our water to 200° F., taking the exhaust from two pumps; when we use three or more pumps we carry the heat at 210° F. with the greatest ease. Moreover, we find that by its use our boiler capacity is materially increased. So far as our experience goes, the apparatus is mechanically perfect, and we cheerfully recommend it to all steam users.

Yours truly, (Signed) W. H. WEISS, President.

The Cochrane Heaters are made by THE HARRISON SAFETY BOILER WORKS, Philadelphia, Pa.

The Douglass blast furnace at Sharpsville is now in complete possession of the Carnegie Steel Co. The lease held by Corrigan, McKinney & Co., of Cleveland, expired on Wednesday. The furnace has not been operated for a long time and is not likely to start.

The Riter-Conley Mfg. Co., of Pittsburg, is making two steel stacks, one for Peru 64 feet high, the other for Vera Cruz, 90 feet high.

The Thomas Iron Co., of Catasauqua, Pa., has made arrangements for the erection of a new furnace, which will be known as No. 3. It will be located at Hokendauqua, and will be the largest in the Lehigh valley.

At auction, Nov. 10, in New York City, 500 shares of Troy Steel Co. (hypothecated), $100 each, sold at $1,000 for the lot, and $17,500 Troy Steel Co., first mortgage, six per cent, 30-year gold bonds, due 1926, Jan., 1898 coupons on (hypothecated), at 60.—[Albany Argus.

The Pennsylvania Steel Co. has all of its four stacks at Steelton in operation. The estimated weekly production is placed at 4,500 tons.

One Bay View furnace of the Illinois Steel Co. has been put out of blast for a relining. One of the South Chicago furnaces has been out of blast for three weeks.

The Meehan Boiler & Construction Co., Lowellville, O., is doing some repair work on a blast furnace at Sharon, also on one at Struthers, and has orders from Parker, S. D., Johnstown and New Orleans, and is completing its contract for rebuilding the Mary Furnace at Lowellville.

The Bellaire Steel Co., Bellaire, O., made 470 tons on a day turn recently, though 750 tons in 24 hours has been considered the capacity of the plant.

A petition for a receiver for the Hanover Foundry & Machine Co., Hanover Pa., says the company is insolvent-assets being $67,000 and liabilities $100,000.

The Eberhard Mfg. Co., Cleveland, is adding a new depart, ment for the manufacture of annealing pots.

A receiver has been appointed for the Duquesne Artistic Iron Co., Pittsburg, on the petition of Jones & Laughlins, Ltd.

The Standard Boiler Co.'s plant at Goshen, Ind., closed for some time, will start up in full.

The rolling mill plant of the Catasauqua Mfg. Co. at Catasauqua, Pa., will be sold at public sale at Philadelphia, Jan. 3.

The Superior Drill Co., Springfield, O., will occupy the plant of the old Amos Whiteley Co., which it recently purchased, about Jan. 1.

The Birmingham, Ala., Rolling Mill, in forge, sheet and bar mill departments, is running very full, working triple turn, a condition that has not been duplicated in many months.

The Edgar Thomson Steel Works shut down Saturday for extensive improvements that will be finished by Dec. 1. The new blooming mill rolls will be the largest ever installed, and a heavy shear will be put in. A new blowing engine will be installed in the converting mill, giving blast sufficient for three converters. With the new blooming mill it will be possible to bloom down a 3-ton ingot in seven passes instead of nine and do the work in about half the time, as speedier tables will be provided. The shears will be operated by electricity, and at one stroke will cut the steel into blooms as it comes from the rolls, seven blooms being made from an ingot, and three rails of 30 feet each from every bloom. The rail mills of the plant showed a capacity of from 1,800 to 1,900 tons of finished rails daily during the past summer.

A receiver has been appointed for the Indianapolis (Ind.) Engine Co. Liabilities $60,000.

The creditors of the Sedgwick Wire Fence Co., Richmond, Ind., which assigned a year ago, have decided not to organize a new company, but to sell the plant. Valuation is $6,000.

The Aschman Steel Casting Co., of Sharon, Pa., has decided to make some improvements and extensions to the plant, expending about $20,000.

The Embreville Iron Co., Ltd., Embreville, Tenn., is pre-

The Q & C Shop Saws

Cut Everything. - - - -

No. 1. Capacity, 4 inches.
No. 2. " 5 "
No. 4. " 8 "
No. 8. " 3x12 "

POWER SAWING MACHINES

For all purposes.

THE Q AND C

Chicago. New York.

Send for Catalogue.

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO,

Proprietors of the CELEBRATED Mount Savage Fire Brick

GOVERNMENT ‡ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Alleganv County, Md.

Branch Offices:—No. 1 Broadway, New York, N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Ferguson Block, Pittsburgh Pa., Stowe, Fuller & Co., 195 Merwin St., Cleveland, Ohio.

OTIS STEEL

"OTIS" FIRE-BOX PLATES A SPECIALTY.

Flange Plates, Ship Plates, Tank Plates, Steel Car Axles and Forgings of all kinds.

Steel Castings from 100 to 75,000 lbs.

Head Office and Works, CLEVELAND, OHIO.

Agencies: NEW YORK, 97 Cedar St. CHICAGO, Old Colony Bldg.
ST. LOUIS, 516 N. Third St. WASHINGTON, Kellogg Bldg.
MONTREAL, Homer Taylor, 183 St. James St.
SAN FRANCISCO, John Woodlock, 154-156 First St.

Conestoga Building, EDWARD E. ERIKSON, PITTSBURG, PA.

Regenerative Gas Furnaces and Water Seal Gas Producers.

Producer Gas under Tubular Boilers, saving 20 per cent in fuel. NO SMOKE.

The A B C of Iron, Now $1.

paring to make a special low phosphorus iron under 0.03 per cent. It will use the magnetic ore of the Cranberry belt. The Johnson City, Tenn., furnace will be used.

After a run of 2½ years, Riverside Furnace, at Steubenville, will be closed down this month. The present stack will be replaced by a larger one, the intention being to attain an output of 400 to 500 tons by means of new equipment.

The rod mill of the Consolidated plant of the American Steel & Wire Co., Cleveland, has shut down for extensive improvements and will not start until after Jan. 1.

Uehling casting and conveying machines are to be put in for the following blast furnaces, construction work being under way for most of them: Shenango Valley Steel Co., New Castle, Pa., a 650-ton machine; Lebanon Furnaces, Lebanon, Pa., a 450-ton machine; Oliver & Snyder Steel Co., Pittsburg, a 450-ton machine for Edith Furnace, Allegheny, and a 500-ton machine for Rosena Furnace, New Castle; Bellaire Steel Co., Bellaire, O., a 600-ton machine for two stacks.

Recent sales of their Cochrane feed-water heaters and purifiers have been made as follows by the Harrison Safety Boiler Works, of Philadelphia: The A. I. Root Co., Medina, O., 300 h. p. special; Wapakoneta (O.) Electric Light & Water Co., 425 h. p.; Latrobe Steel & Coupler Co., Melrose Park, Ill., 1,000 h. p.; American Cement Plaster Co., Mulvane, Kan., 100 h. p.; Monessen (Pa.) Steel Co., 1,250 h. p.; Texas & Pacific Ry. Co., Dallas, Tex., 50 h. p.; A. & M. Moses, Natchez, Miss., 300 h. p.; Fish Bros. Wagon Co., Racine, Wis., 500 h. p.; Lawrence Limestone Co., Wampum, Pa., 150 h. p.; National Tube Works Co., McKeesport, Pa., 3,000 h. p.; Cherry Valley Iron Co., Leetonia, O., 1,750 h. p.; Delaware & Hudson Canal Co., Olyphant, Pa., 2,500 h. p.; Edwardsville (Ill.) Electric Light & Power Co., 150 h. p.; Raritan Copper Works, Perth Amboy, N. J., 1,000 h. p.

ENGLAND'S TRADE DECLINE.

The memorandum compiled by the Board of Trade on the ways and methods of British trade is not pleasant reading, and the moral which the memorandum teaches is not the less grave that it is an old one, often enforced in these columns. No fewer than 116 diplomatic and consular officers make reports from all parts of the world, and, with scarcely an exception, the reports lament and condemn the shortcomings and supineness of the British trader. He is being ousted in countries in which he once had no rivals; he is gaining access to few new markets; and he suffers in the struggle for existence, not because other nations are becoming as enterprising as he, but because they are advancing while he is stationary or is falling behind. He will not see that everywhere trade is changing. And so he will not supply cheap articles, but allows the demand for them to be satisfied by Germany or America.

"The Briton does not care to sell unless he gets large orders, whereas the others book and execute small orders." The same want of pliability and adaptiveness appears in the refusal to study customers' wants, probably the most serious obstacle to the spread of British trade.

Akin to this falling is the disinclination to grant credit facilities to customers so freely as is done by German houses. Where English houses give only two or three months' credit, or insist upon payment on delivery, German firms give at least six months' credit, so as to allow time for the sale of the consignment before payment. Our rivals do not sell for the mere sake of selling; and, if they do not with this system make many bad debts, it is that they have better means of information as to the character of their customers. Even our colonies are visited by few English commercial travelers, and those who are sent out to foreign parts are rarely well equipped for their work. They do not always know the language of the country, and they have not sufficiently studied its requirements. It seems incredible that English men of business should conduct their affairs in the fatuous manner thus described.

In the opinion of the consuls, there is too much reliance upon "flooding the consulate swith elaborately and artistically got-up catalogues, price lists, etc., containing a request that they should be distributed or placed at the disposal of dealers"—a "system" pronounced "absolutely valueless."

"One commercial traveler, knowing the language and the ways of the people, will do more than ten thousand circulars," says our consul at Cherbourg; and this is the purport of all the reports. The American exporters to Russia sent out, we are told, enormous quantities of illustrated price lists; but they

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take care to give the prices reduced to Russian rubles, duty paid, with exact information as to weights, all printed in the Russian language. The English catalogues, on the other hand, give price lists in the English language and in English currency. "As generally no weights are given, the would-be purchaser cannot even guess what the duty would come to, and, considering that, roughly speaking, the duty varies from 40 to 90 per cent of the cost price, according to the weight and the different classes of metal employed, such price lists are useless to Russian buyers." When an English firm sends out an agent to look after its interests or to open new markets, the probability is that, if he is not a German, he is ignorant of the language of the country. "It is pitiable," writes our consul at Naples, "to see the British commercial traveler stumbling along with an interpreter, while his German competitor is conversing fluently, and one is still more sorry for him when his patterns and samples are marked with British weights and measures." Moreover, our merchants do not pack their goods as their customers desire. Perhaps they know what is best as to this and all other practical details; but it is curious that they should not fall in with the wishes of the latter as to a point on which the German exporters show themselves accommodating.

It would also appear to be the fact that in some markets the British manufacturer is placed at a disadvantage by reason of high freights. The frequency of strikes, too, is a serious element. A prudent manufacturer or producer in some branches of trade inserts a strike clause in his contracts. The contractor is often obliged to ask an extension of time, and this naturally turns the thoughts of customers to countries where business is less disturbed. The report mentions many instances in which orders intended for England have gone elsewhere in consequence of the engineers' strike.—[London Times.

Cheap Cab Service for Washington Visitors via Pennsylvania Lines.

A complete and efficient cab service similar to that in operation at passenger stations of the Pennsylvania system at Broad street, Philadelphia, and at Twenty-third street, New York, has just been established at the Pennsylvania Passenger Station in Washington, D. C. The service is satisfactorily performed at very reasonable rates by brand new rubber-tired coupes, victorias and omnibuses. The vehicles will be found at the cab stand at the B street entrance to the Washington station, and may be engaged by the trip or by the hour. Visitors to the National Capital will find the new arrangement a very convenient one.

Excursion Rates via Pennsylvania Lines for Thanksgiving Day.

For the accommodation of persons who may wish to make Thanksgiving Day trips, non-transferable Excursion Tickets will be sold Thursday, November 24th, from ticket stations on the Pennsylvania lines west of Pittsburg to any station on those lines within one hundred and fifty miles of selling point. Tickets for adults will not be sold for less than 25 cents, nor for children at less than 15 cents. Excursion tickets will be good returning up to and including Friday, November 25th. For details apply to nearest Pennsylvania Line ticket agent.

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